REMOTE DIAGNOSTICS IN WESTERN EUROPE

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1 INTRODUCTION

I INTRODUCTION

A. SCOPE

- This report is produced by INPUT as part of its European Field Service Programme.

- As the first European major issue report released under this subscription service, it focuses on the current state, techniques and trends of remote diagnostics within European field service organisations.

- The topic of remote diagnostics was selected based on the high level of interest expressed by clients in the programme.

- The report addresses issues and specific areas of interest suggested by INPUT's clients.

B. METHODOLOGY

- Research carried out for this report included a series of 21 interviews with major vendors of data processing equipment in Europe, as shown in Exhibit I-1.

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EXHIBIT I-1

TYPE OF VENDOR COMPANIES INTERVIEWED

PRODUCT / COMPANY	MAIN-FRAME	MINI	SERVICE BUREAU	U.K.	EUROPE	USA
1	X			X		
2	X			X		
3	X	X		X	X	
4	X	X			X	
5		X			X	
6		X			X	
7	X			X		
8			X		X	
9		X		X		
10		X		X		
11		X		X		
12		X		X		
13		X		X		
14	X			X		
15		X			X	
16		X			X	
17		X				
18		X			X	
19	X					X
20		X				X
21		X				X

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- These interviews were conducted with the engineering manager or supervisor with prime responsibility for remote diagnostic operations or implementation.

- Of the 21 interviews conducted, five were in-depth, on-site interviews and 16 were telephone interviews.

- On-site interviews lasted up to four hours, while phone interviews averaged 40 minutes in length.

- Because of the nature of the information provided, INPUT agreed to keep the names of the companies interviewed confidential. However, where information is on public record or used in advertising brochures, the companies are identified.

- Research was also carried out by INPUT into user reactions to, and experience with, remote diagnostics.

  - These interviews were conducted with the data processing or operations manager of users of data processing equipment.

  - A total of 55 in-depth phone interviews of approximately 30 minutes duration each were carried out, principally in France, Germany and the U.K.

- Remote diagnostics definitions are shown in Appendix A.

- Copies of the questionnaires used are contained in Appendix C.

- Clients are invited to enquire or comment on the information presented in this report.

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II EXECUTIVE SUMMARY

II EXECUTIVE SUMMARY

A. REMOTE DIAGNOSTICS: STATUS AND TRENDS

- Remote diagnostics involves fault detection, debugging and system checking from a remote site by the use of telephone lines and/or data links; it is a cost effective tool that will gain rapid user acceptance.

- Ninety-five percent of vendors interviewed already had introduced, or planned to introduce, remote diagnostics. One vendor said, "We will be dead without it." Those vendors who have already introduced remote diagnostics rated it even more highly than those who have it in the planning stage, indicating that remote diagnostics are proving successful.

- It is clear that there is a degree of reluctance on the part of some vendors to push ahead with remote diagnostics.

  - Some vendors are afraid of being rejected by the customer, but this rejection did not materialise in INPUT's studies.

  - Half of the users interviewed in this study felt that system availability had actually improved through the use of remote diagnostics, thereby reinforcing their support of the technique.

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- European users are more receptive to the concept of remote diagnostics than are American users, based on a comparison of U.S. and European surveys carried out by INPUT.

- Pressures on vendors have accelerated the need for effective remote diagnostics. These pressures derive from a number of sources:

  - Customers demanding faster response and repair times.

  - Shortage of high-quality engineers.

  - Growth in equipment complexity.

  - Internal demands to reduce costs and improve profit performance.

  - Lack of an effective management reporting system.

  - Need for better utilization of field engineers.

  - The need for establishment of a 'standard' service.

- In order to respond to these pressures with remote diagnostic systems, field engineering organisations must plan for several major difficulties.

  - Users expect a reduction in maintenance costs.

  - Engineering organisations will need restructuring.

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B. VENDOR FIELD ENGINEERING ORGANISATIONAL CHANGES

- Fifty percent of the vendors interviewed have already experienced organisational changes. These typically involve setting up centres staffed by remote diagnostics experts.

- There will be a shift in the quality and expertise of field engineers during the coming decade, as illustrated in Exhibit II-1.

  - Many field engineers will become board 'swoppers' under the direction of the remote diagnostic center.

  - There will be a re-emphasis on the mechanical skills needed to handle printers, disc drives and similar types of equipment.

  - Some high-quality, on-site engineers will be required, mainly for high-security sites which will not permit remote diagnostics to be used.

  - A career bottleneck will develop because of the growing gulf in expertise between the field 'engineers' and the remote diagnostic engineers.

- Some degree of dissatisfaction can be expected among field engineers.

  - No difficulties or unrest have yet been reported by any of the vendors using remote diagnostics.

  - However, training on new equipment, a traditional FE motivator and reward, will lessen because of remote diagnostics.

  - As the majority of field engineers are not unionised, there will be little effective resistance from them in the near term.

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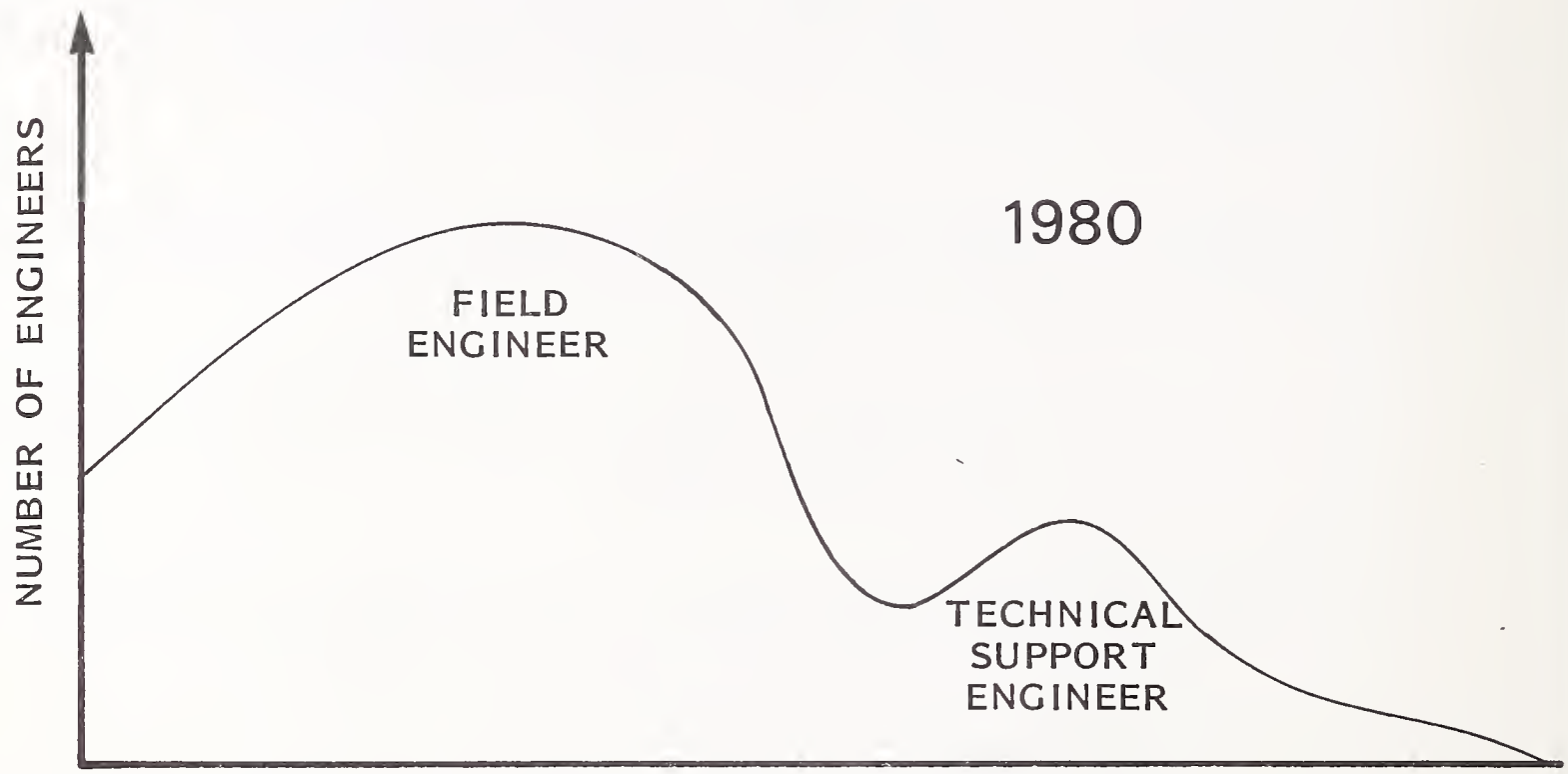
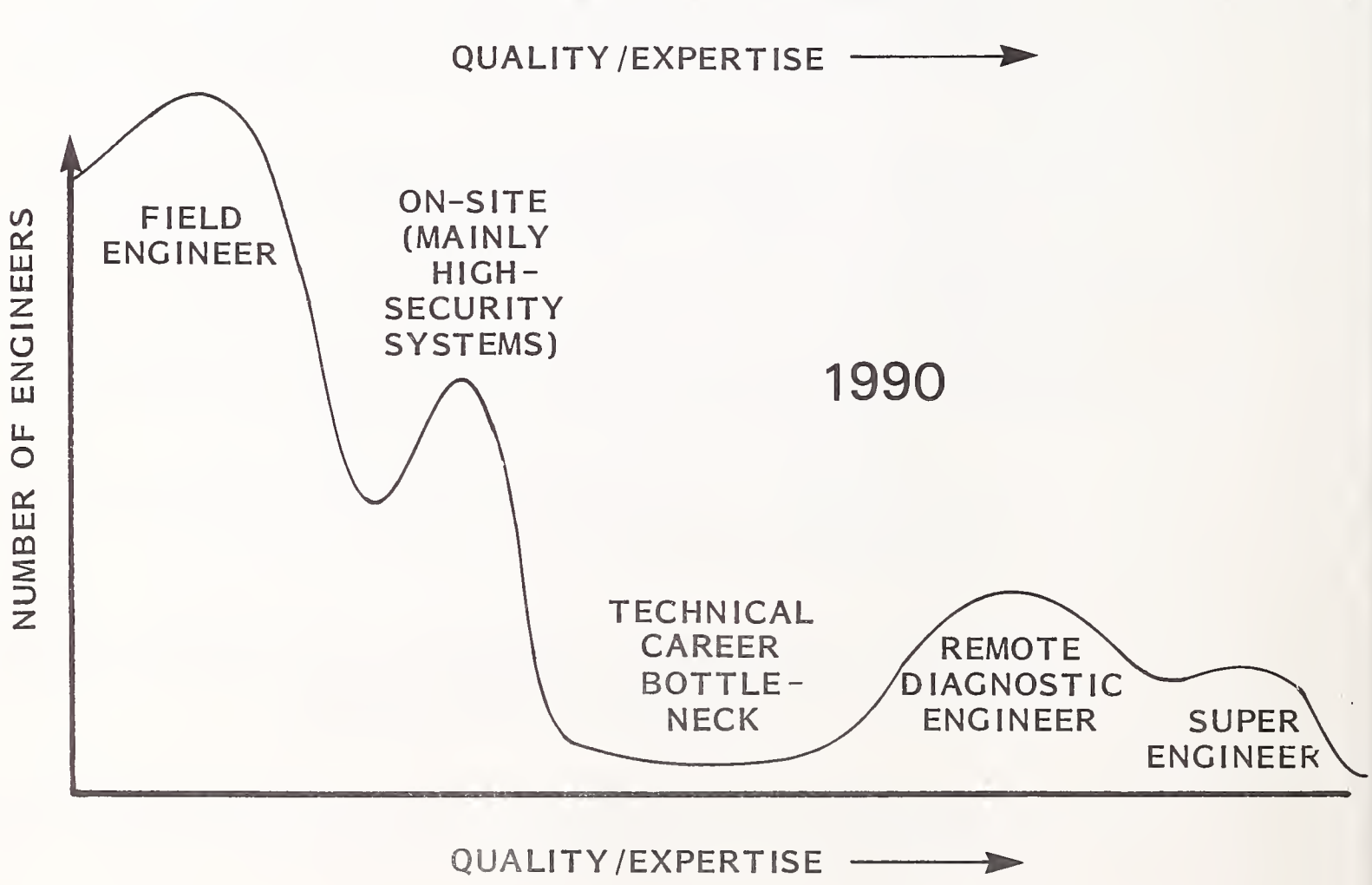
EXHIBIT II-1

CHANGES IN THE DISTRIBUTION OF ENGINEERING QUALITY AND EXPERTISE





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- There will be some migration of technically orientated engineers to smaller and less 'remote diagnostically advanced' organisations.

- Decreasing requirements for high levels of expertise will open new areas for recruitment. These include PTT engineers and office equipment maintenance personnel.

C. USER EXPECTATIONS

- Users will expect a reduction in maintenance charges because they believe that maintenance fees are primarily for the time spent by engineers working on-site and not for an 'insurance policy on the hardware'.

  - DEC's offer to reduce maintenance charges for users accepting remote diagnostics supports this expectation.

- An overreaction to the possibilities of remote diagnostics by the press and certain vendor organisations has also added to the expectations of price decreases.

- Some users are concerned that the on-site engineer will disappear, leaving them without a necessary support capability.

  - Vendors must endeavour to wean users from the traditional concept that 'happiness is an engineer on-site'.

- The term 'data security' describes users' and vendors' concerns about two separate problems:

  - Unauthorised access to a firm's confidential data.

  - Loss or corruption of data stored in the system.

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- The latter is the larger problem because mistakes have been made as a result of the inexperience of both engineers and users dealing with remote diagnostics.

  - Unauthorised access to parts of the system can be controlled by software or mechanical lockout procedures.

D. SIGNIFICANCE OF REMOTE DIAGNOSTICS ON THE IBM 4300

- The integration of remote diagnostics is a major aspect of the IBM 4300 series, introduced in January 1979. INPUT's interviews with 4300 users in the U.S. provide insight into the issues of pricing and the importance of the on-site FE - two issues that are discussed in the body of this report.

- IBM priced maintenance on the 4300 mainframes significantly below the 370 series they replace, thereby giving a user justification for supporting remote diagnostic techniques and relying on this technique to partially replace preventive maintenance, which is not part of the 4300 maintenance procedures.

  - As shown in Exhibit II-2, the mainframe maintenance on an IBM 4331 is only 14% of the maintenance on the 370/138 it may replace.

  - If the more powerful 4341 is used as the comparable model (the 370/138 is being replaced by both 4331s and 4341s, according to recent surveys), then 4341 maintenance is only 43% of the 370/138. (Details of the hardware used in this comparison are shown in Appendix B.)

  - The magnitude of these reductions indicates the decrease in maintenance costs that IBM is expecting, due to a combination of remote diagnostics, more reliable hardware and fewer replaceable parts.

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EXHIBIT II-2

COMPARATIVE ANNUAL MAINTENANCE CHARGES FOR IBM 4300 AND IBM 370 SYSTEMS

ITEM	IBM 4331		IBM 4341		IBM 370/138	
	ANNUAL MAINTE-NANCE	% OF PURCHASE	ANNUAL MAINTE-NANCE	% OF PURCHASE	ANNUAL MAINTE-NANCE	% OF PURCHASE
CPU	$2,310	3%	$ 6,758	3%	$16,020	6%
I/O	7,726	7	15,450	6	9,416	8
TERMINALS	2,106	7	2,838	7	1,800	8
TOTAL	$12,142	5%	$25,046	5%	$27,236	7%

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- IBM's strategy regarding sustaining overall maintenance revenue growth is also apparent in Exhibit II-2. The imput/output devices and the terminals are generators of maintenance revenues that largely offset the lower revenues on the CPU.

- Early 4300 users in the U.S. are satisfied with the maintenance supplied. Exhibit II-3 illustrates that:

  - The remote support center concept gains a rating of 4.0 (on a scale where 5=high and 1=low), without hindering an even higher level of satisfaction with the support still being provided at the central (on-site) location; to date, the sites evidently are satisfied with the combination of on-site and remote support being delivered on the IBM 4300.

  - Those users with IBM leases show slightly higher levels of satisfaction indicative of their greater commitment to the vendor.

  - It is too early to judge the satisfaction of users who have systems involving multiple IBM sites, since early installations of 4300s are typically single-site applications.

  - As multiple-site applications are installed, remote diagnostics can be very helpful in determining which site is the source of a problem; as discussed in later sections of this report, IBM's strategy involves the use of remote diagnostics across mainframe product line, thereby paving the way for diagnosing distributed systems with a compatible remote diagnostics scheme.

E. RECOMMENDATIONS

- Remote diagnostics should be used as a device to help compete with third-party maintenance firms.

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EXHIBIT II-3

REACTION OF EARLY IBM 4300 USERS TO QUALITY OF MAINTENANCE

SATISFACTION CATEGORY	RATING OF SATISFACTION (5 = HIGH, 1 = LOW)	
	PURCHASE	IBM LEASE
OVERALL	4.0	4.4
REMOTE SUPPORT CENTER	4.0	4.0
CENTRAL SITE	4.3	4.5

NOTE: RESPONSES EARLY IN PRODUCT CYCLE
ABOVE BASED ON 18 RESPONSES
ONE RESPONDENT WITH A REMOTE SITE RATED SATISFACTION AS "LOW"
AT THAT SITE

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- Vendors should have a clear strategy relative to user involvement.

  - Current vendors are split almost equally on the question of whether the FE or the user should initiate the remote diagnostics procedure; those with on-site engineers prefer to have their engineers decide whether remote diagnostics should be used.

  - However, in the future most users will be expected to initiate the remote diagnostics. This will allow vendors:

    . To reduce the number of on-site engineers.

    . To pre-qualify problems prior to dispatching an engineer. In theory, the right person with the right parts would be sent to the repair site.

    . To reduce site visits by field engineers to problems that have been user-induced.

    . To have more effective management reporting.

- The management reporting facilities and potential in remote diagnostic systems are very great and must be used to improve the effectiveness of FE organisations.

  - With effective reporting, true measurement of field engineering performance will be possible.

  - Shortfalls in mean time between failures and mean times to respond and repair, will become quickly apparent, allowing management to take immediate and measurable action.

- Vendors should accelerate efforts to get their users to accept remote diagnostic systems in order to obtain the benefits discussed above.

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- Management must develop career paths that recognize the technical career bottleneck between the lower skill levels needed by on-site engineers and the higher skill levels needed among remote diagnostic engineers.

  - Those on-site engineers with the potential to be trained can make the transition to the higher skill levels.

  - Some companies will find it necessary to bring people directly into the higher skill levels.

  - Failure to anticipate career path issues will eventually lead to worker dissatisfaction and the potential for increased union activity.

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III REMOTE DIAGNOSTIC TECHNIQUES

III REMOTE DIAGNOSTIC TECHNIQUES

A. INTRODUCTION

- This chapter describes five remote diagnostic systems currently employed by vendors in Europe. The systems considered are those supplied by:

  - DEC.

  - A large mainframe vendor.

  - A plug compatible vendor.

  - CDC.

  - IBM.

B. THE DEC SYSTEM

1. GENERAL

- Digital Equipment Corporation (DEC) offers an automated computer remote diagnostic system entitled 'Remote Computerized Diagnostic' (RCD). It is

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currently used with PDP 11/70-based systems. However, DEC plans to extend the system to include the VAX 11/780 by late 1980.

- In Europe, the system is available in the U.K. from the diagnostic center located at Basingstoke, England, and in France from a site at Vallone.

- As of July 1980, DEC claimed to have 80 customers using RCD. New subscribers are expected at a rate of 100 per month. DEC projects that over 10,000 customers will be using RCD by 1985.

- DEC has already invested over $6 million to establish the service in Europe.

- Reduced mainframe maintenance contract prices are offered to induce customers to use the RCD system. Examples of the reductions are:

  - $35/month on PDP 11/70 and VAX 11/80.

  - $75/month on PDP 11/44.

- The performance figures cited by DEC, which appear extremely significant, are based on its experience to date with RCD.

  - Thirty percent of all fault calls are solved over the telephone by having the operator take some simple corrective actions, without any participation by the FE.

  - RCD's success rate in isolating the failed part of the system is approximately 90% for the remaining 70%. An FE is then dispatched with the required parts in hand to repair the system.

  - These results should hold up when the system is expanded. Savings in aborted site visits alone will yield substantial savings to DEC.

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2. SYSTEM COMPONENTS

- DEC's RCD system is shown schematically in Exhibit III-1.

  - The host system, resident at the remote diagnostic center, consists of dual PDP 11/70s interfaced to a network controlled by PDP 11/04s. The latter provide message switching and auto-dial facilities.

  - The user's system requires a special console, designated the KY11-RE, which replaced the standard operator console.

    . The console, which contains a built-in microprocessor, has its own self-test facility so that the operator can determine if the console itself has a fault.

    . VAX systems will have the console's special facilities integrated.

  - An on-line disc storage unit at the host system contains data on customers, their system's performance history and their machine configuration.

  - Diagnostic routines are maintained at the customers' sites and kept on disc and/or tape.

3. SYSTEM OPERATION

- System operation procedures for the DEC RCD system are shown diagrammatically in Exhibit III-2.

  - When a fault is detected, the customer initiates the procedure by telephoning the Service Response Group (SRG) located at the remote diagnostic center.

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EXHIBIT III-1

DEC REMOTE DIAGNOSTIC CENTRE

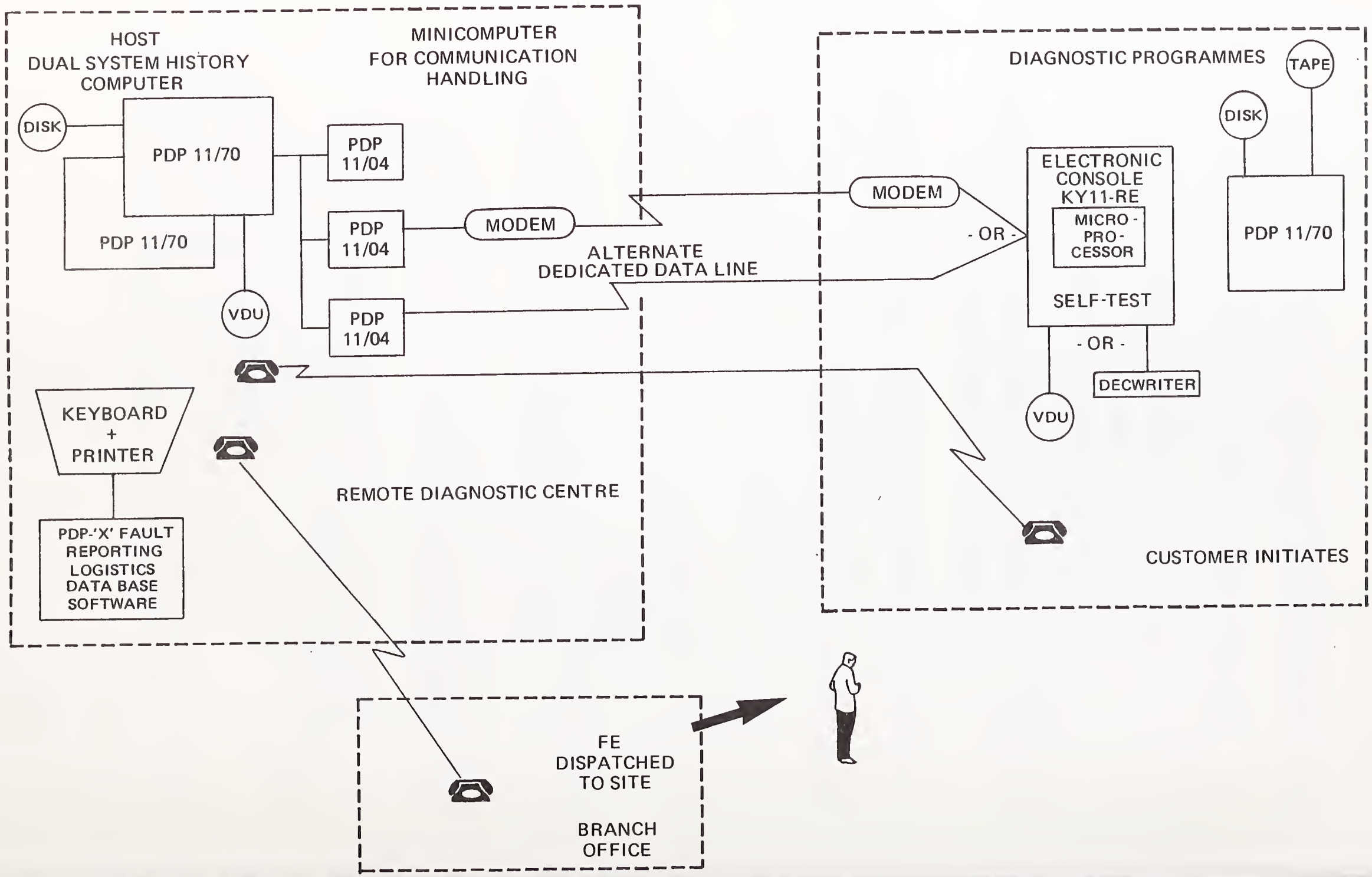
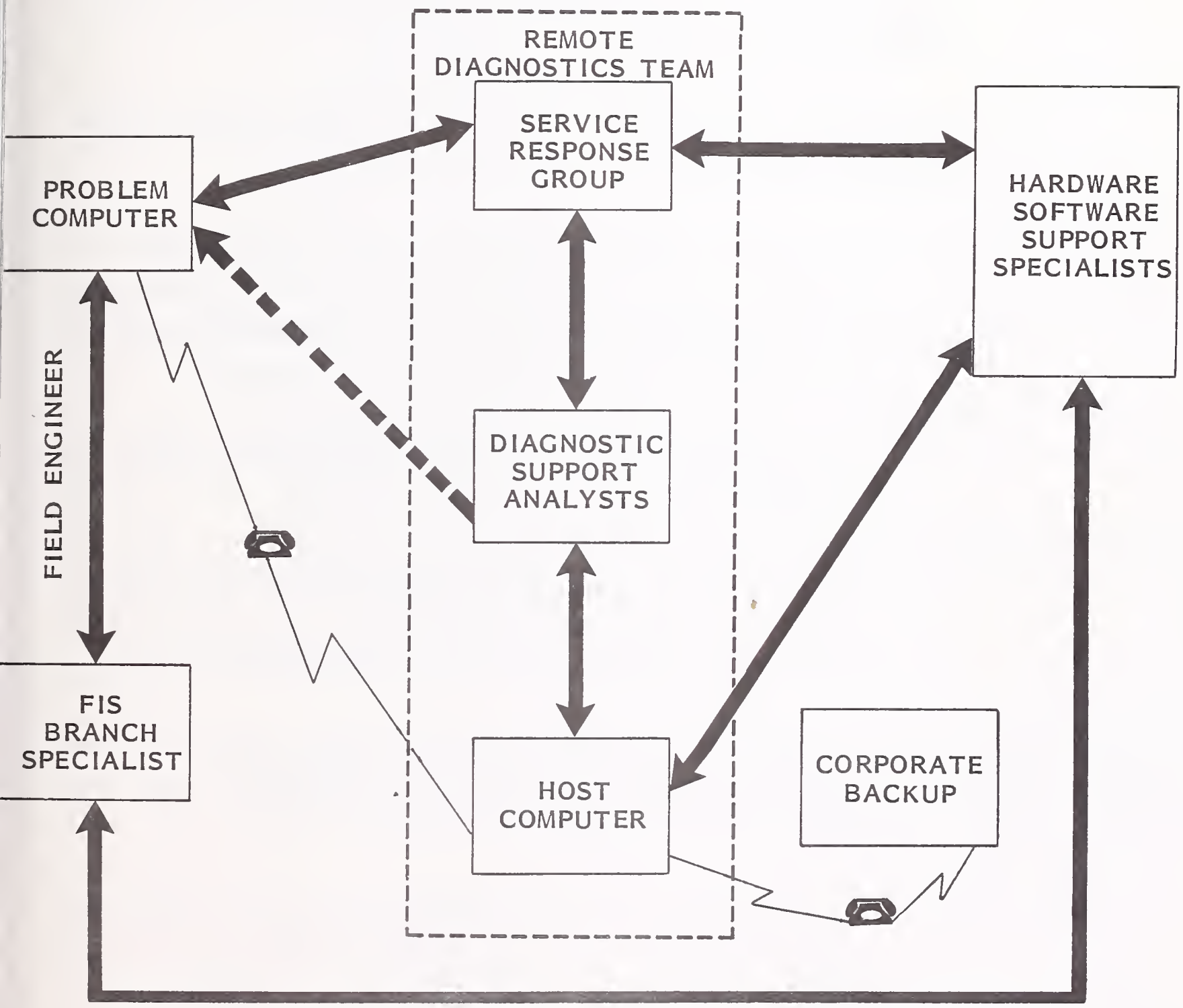


EXHIBIT III-2

DEC SYSTEM OPERATION AND PROCEDURE



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- The SRG engineer logs the call and discusses the fault with the customer. If he determines that the fault is operator-induced or is an environmental problem, the customer is advised accordingly. If it is a software problem which the SRG engineer is not able to resolve himself, the contact will be passed to a software support group.

- If the fault is determined to be a straightforward peripheral failure, the SRG passes the call to the appropriate local service branch, which dispatches a field engineer to the customer's site.

- If the fault is thought to be a mainframe or system problem, remote diagnostics will be used.

  . To operate the remote diagnostic system, the customer first removes his storage media or ensures that it is write-protected. He then switches the console to 'remote', which effectively passes control of the system to the remote diagnostic center.

  . The local service branch is immediately advised to enable pre-scheduling of a possible visit by a field engineer.

  . Diagnostic tests are then run and monitored by the SRG engineer until a fault or test failure is encountered. Test results and data are displayed on a DEC writer at the remote diagnostic center.

  . A local service branch is then advised to dispatch a field engineer who will be armed with the parts needed to repair the fault.

  . Once the problem is repaired, the field engineer informs the SRG engineer, who then reruns the appropriate diagnostics to prove that the repair has been effected. Control is then returned to the customer.

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- One of the more interesting features of the DEC system is that the SRG can run parts of the preventive maintenance test schedule. This is particularly attractive because these tests can be executed during non-prime shift hours.

- On the VAX 11-780, when an operator suspects or detects a hardware error, he:

  - Mounts a diagnostic disc pack.

  - Loads a diagnostic floppy disc in the console.

  - Selects 'remote diagnostic' on the console switch.

  - Calls the diagnostic center.

- Once he has done this, no other activity is required from the site.

- The diagnostic center runs the 11-780 automated diagnostic package or operates the diagnostic console manually.

- If a problem is found, then a field engineer is sent with the required equipment and replacement modules.

4. BENEFITS

- The DEC remote computerized diagnostic system provides several benefits to both DEC and its customers. The customer gets better system availability because mean times to respond and repair are improved.

- For DEC, the system provides:

  - Centralized fault reporting, which enables the automatic recording of all system failures and fixes. Statistical analysis of this data should make a major contribution to reliability improvement programmes.

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- Better utilization of both specialist and field engineers; i.e., they can apply expertise in a rational manner.

- The ability to provide the correct spare parts where and when needed. This should enable DEC to reduce its inventory of spare parts maintained in the field.

- Detailed reporting of field engineer activity which should lead to improved productivity.

5. MANAGEMENT PROBLEMS

- At the moment, DEC reported no problems from the field engineer but, as it is a new concept, the FE organisation has not yet experienced the full effect.

- One engineer voiced the fear that he was no longer in control and that much of the decision making had been removed from him. He was afraid that he would be no more than a board "swopper" in the foreseeable future.

- INPUT does concur with the fear that the level of expertise required of DEC field engineers will decrease with time.

B. LARGE MAINFRAME VENDOR

1. GENERAL

- INPUT examined the remote diagnostic system provided by a large mainframe vendor who asked that its name be withheld.

- The diagnostic system is not 'sold' as an additional feature, but is provided as an integral part of the maintenance system. It is used exclusively by the company's field engineers, who are usually resident on-site.

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- The system was developed in the U.S., where the vendor presently has three remote diagnostic centers. These facilities were originally used by all customers throughout the world. Europe is now served by a single center located in West London.

- One of the system's primary concepts is that it functions as an additional tool for the on-site engineer.

  - Use of the system is initiated by the field engineer from the customer's site.

  - It is used primarily to deal with the more complex problems.

- This approach was conceived some eight years ago, and was first used in the field in 1975.

2. SYSTEM COMPONENTS

- This remote diagnostic system is illustrated schematically in Exhibit III-3.

- Key features of the system are the 32-bit minicomputers, made by another vendor, at both the customer's site and the remote diagnostic center.

  - The customer's minicomputer interfaces directly into the system console and also has a coax pipeline to the system's I/O ports. It is equipped with its own fixed and floppy disc drives, which are used for error logging and storage of support programmes.

  - The diagnostic center mini is a mirror image of the customer's unit. Both devices communicate via modems and dial-up lines at a transmission rate of 1,200 baud.

  - Both devices are equipped with identical system keyboards and CRT displays.

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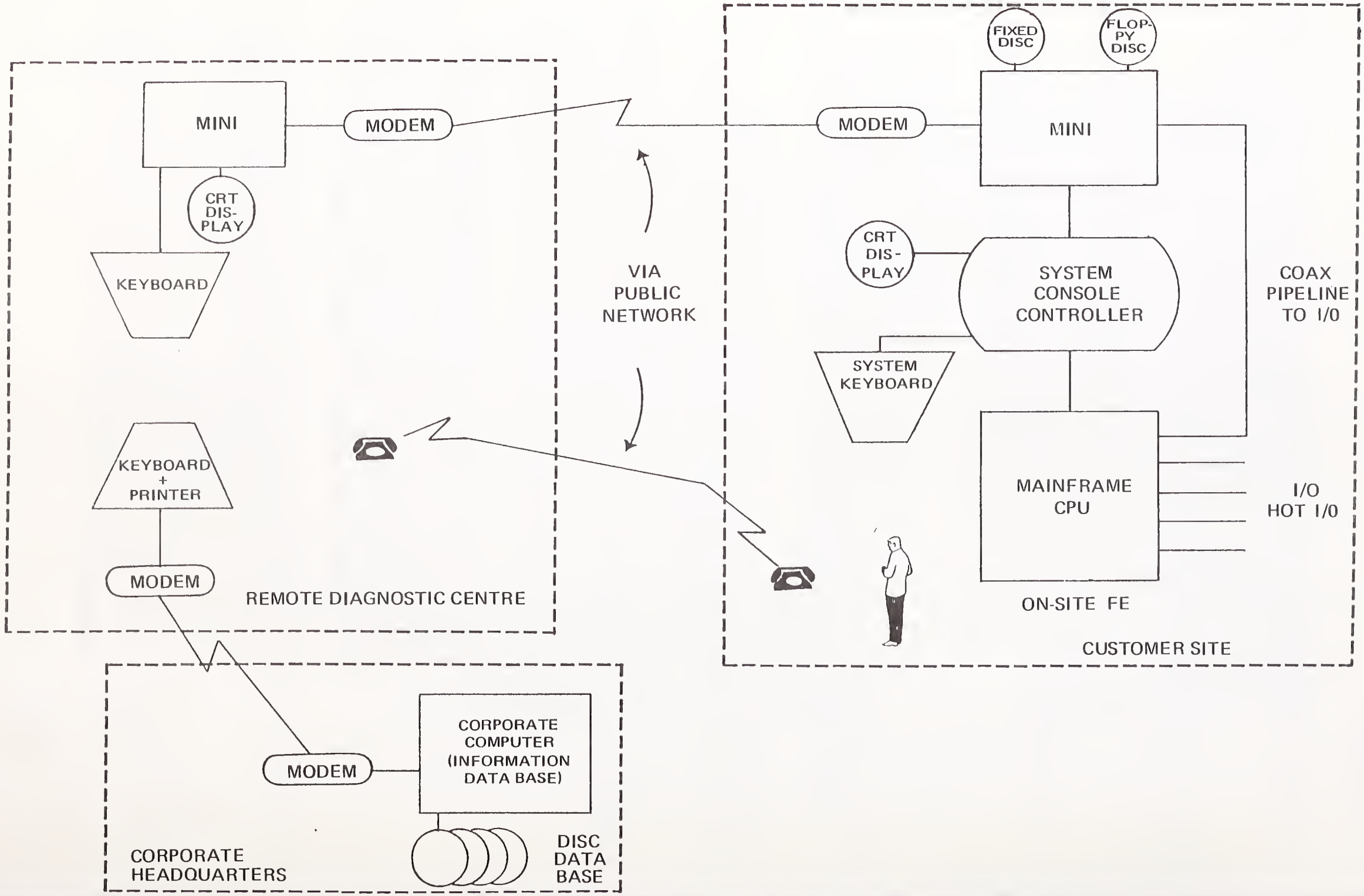
EXHIBIT III-3

TYPICAL LARGE SYSTEM REMOTE DIAGNOSTIC SET-UP



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- The remote diagnostic center is tied (via telecommunications) to a large central computer located at corporate headquarters in the U.S. This computer contains a substantial data base of faults and fixes together with other maintenance- and diagnostic-related information.

- Control of the customer's system can be passed back and forth between the on-site field engineer and the engineer located at the remote diagnostic center.

3. SYSTEM OPERATION

- As stated earlier, the on-site field engineer initiates the request to use the remote diagnostic facility. The latter is staffed 24 hours per day, seven days per week.

- The center acts as a technical support function. It reviews the actions of the on-site engineer and revises them if appropriate. It also may initiate new tests or recommend alternative courses of action.

- At all times, the controls and the diagnostic information displayed are identical at both the site and diagnostic centre. In addition to the running of diagnostic routines, the system can be single-stepped under the control of either mini, with latch points shown on the display.

- When diagnosing complex problems, the diagnostic center typically takes control. The on-site engineer acts as the centre's 'hands' for mechanical functions and viewing and reporting on oscilloscope wave forms.

4. BENEFITS

- This vendor has demonstrated the effective way a remote diagnostic system can be integrated into a field service organisation.

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- With over five years of experience running remote diagnostics, the European Technical Director stated that he would need three to four times the technical expertise in the field to provide a similar service without remote diagnostics.

- Remote diagnostics has been a significant factor in maintaining this vendor's leading edge in a very competitive marketplace.

- Remote diagnostics is a tool welcomed by the engineer in the field:

  - He retains control of 'his site'.

  - Due to the clearly defined and separated reporting structure, as shown in Exhibit III-4, the engineer has no fear of the 'big brother' image that can be associated with remote diagnostics.

- On-site engineers are the 'norm' for this vendor and, as long as this remains true, he does not plan to change his structure of reporting or use of remote diagnostics.

C. PLUG COMPATIBLE PERIPHERAL EQUIPMENT VENDOR

1. GENERAL

- A problem faced by the vendors of plug compatible equipment is to determine quickly whether the system fault is with their subsystem or with the host computer. Field engineers spend over 15% of their time attending faults that are not their responsibility.

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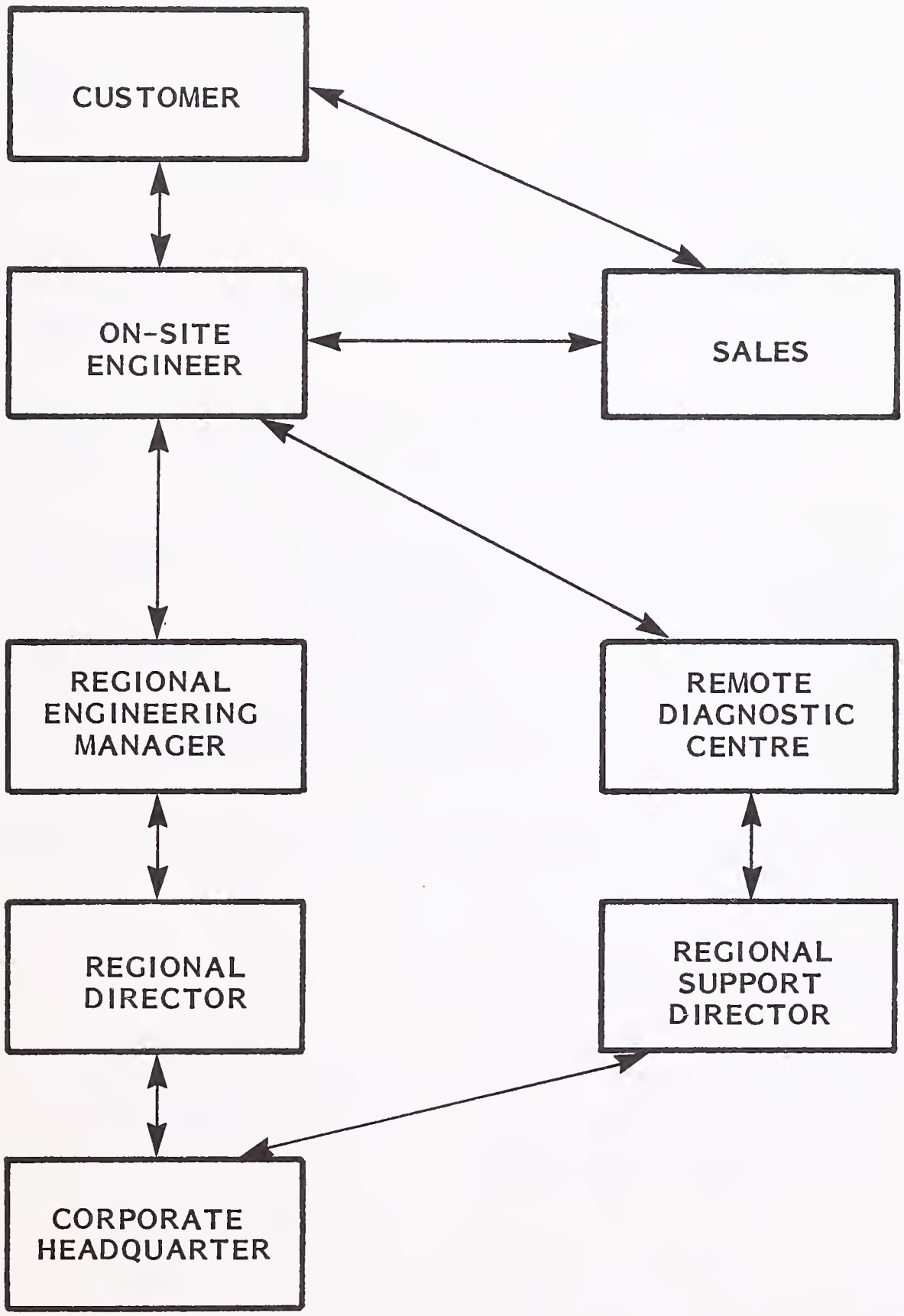
EXHIBIT III-4

MAINFRAME VENDOR
REPORTING STRUCTURE



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- To reduce this waste of time, a major plug compatible vendor is using remote diagnostic techniques to pre-qualify the responsibility. The vendor currently only views remote diagnostics as an aid to improving the efficiency of the field engineers. As the project is only at a pilot stage, it can be expected that this outlook will broaden to include management reporting, etc.

2. SYSTEM COMPONENTS

- The basic organisation of system components is shown in Exhibit III-5.

- A microcomputer is added to the subsystem controller.

  - This microcomputer can be connected to a remote terminal device via a dial-up line and acoustic coupler operating at 300 baud.

  - The microcomputer has a hard-wired connection to the subsystem controller's firmwire.

- Field engineer access to the subsystem firmware is provided via the remote terminal, acoustic coupler and microcomputer.

  - With this firmware, the field engineer can exercise the subsystem controller and connected devices (i.e., disc drive).

  - Results from these tests are transmitted to the remote terminal for analysis.

3. SYSTEM OPERATION

- A user with a possible problem with his plug compatible device calls the vendor's duty engineer. The user discusses his problem with the duty engineer to establish operational details.

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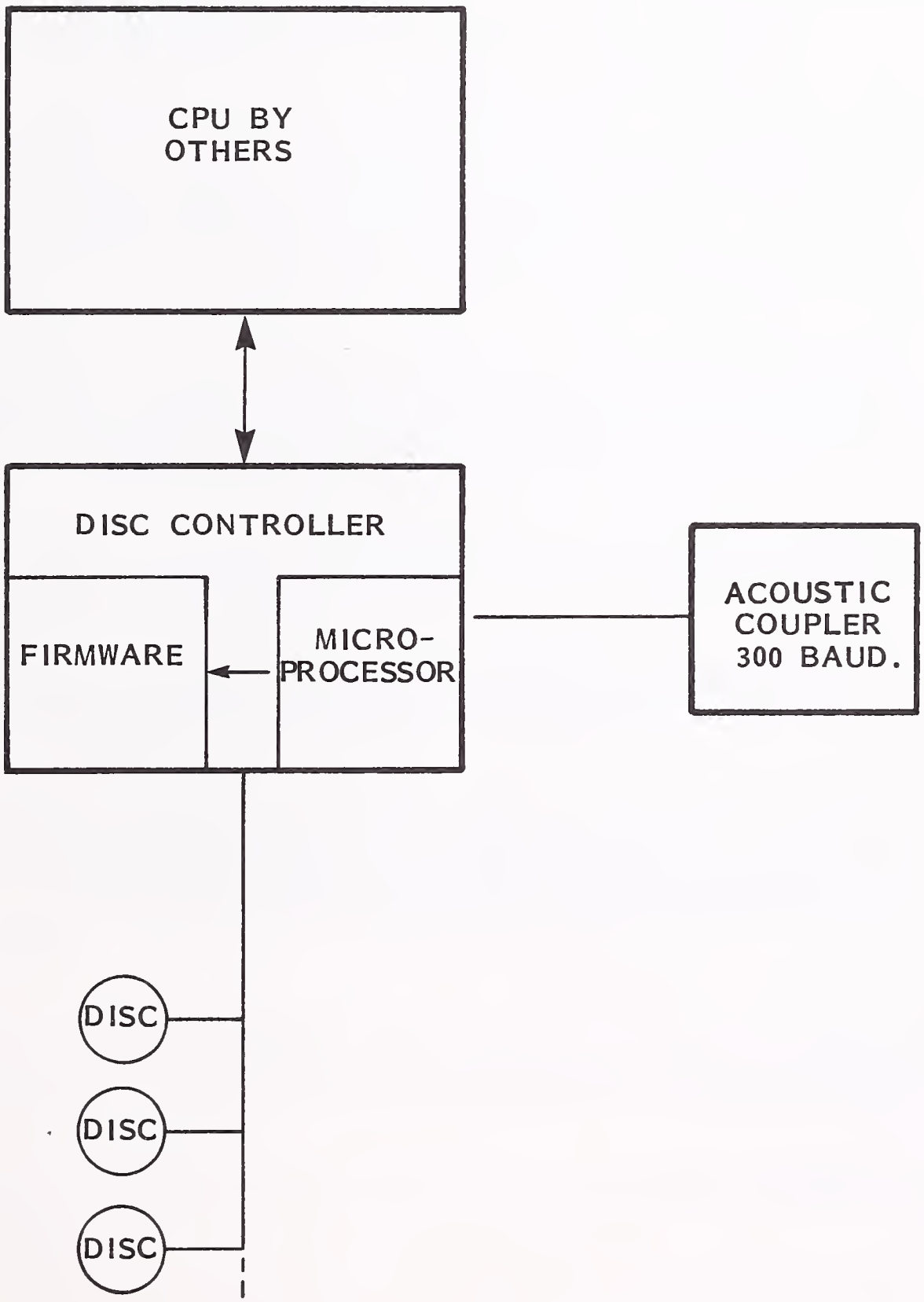
EXHIBIT III-5

PLUG COMPATIBLE EQUIPMENT VENDOR
SYSTEM - SCHEMATIC



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- If the duty engineer requires, the user can connect him to the subsystem controller.

  - The user removes all his media from the subsystem.

  - The user mounts scratch tapes and/or discs as requested.

  - The user connects the telephone to the acoustic coupler and enables the remote diagnostic switch.

- The duty engineer, via his accoustic coupler and silent 700, tests the subsystem in the same way as if he were on-site. He can carry out all the normal operations plus some basic timing tests.

- Results displayed on his terminal will allow him to ascertain if he has a problem with his subsystem. If the subsystem is clear, then the engineer advises the user to contact the host computer's engineer.

4. ORGANISATION

- This type of use of remote diagnostics has had no effect on the vendor organisation, and the vendor is not intending any major changes.

- Remote diagnostics is a tool to enable the engineer to decide if a site visit is necessary. This will improve the overall efficiency of the engineer, but will have no effect on the type or usage of the engineer.

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D. CONTROL DATA

1. GENERAL

- A senior manager of CDC's Engineering Department recently predicted that, in the foreseeable future, engineers would no longer have offices but would work from their homes!

- The distributed processor and loosely coupled network lends itself to remote diagnostics. Control Data is firmly committed to developing various maintenance support services via remote diagnostics.

2. SYSTEM COMPONENTS

- Exhibit III-6 shows a typical configuration for remote diagnostics on a CYBER 173.

- Access to the system is via a modem to the system communications network multiple subsystem (255X).

  - This subsystem is linked via a data channel coupler to the host CYBER system.

- The data channel connects to a peripheral processor unit via a matrix switch. The peripheral processor has access to the central memory and central computer.

- Any compatible terminal device can be used to gain access to the system. Currently the preferred terminal is the SILENT 700 with an acoustic coupler.

- Access is gained to the system via the normal protocols and security passwords.

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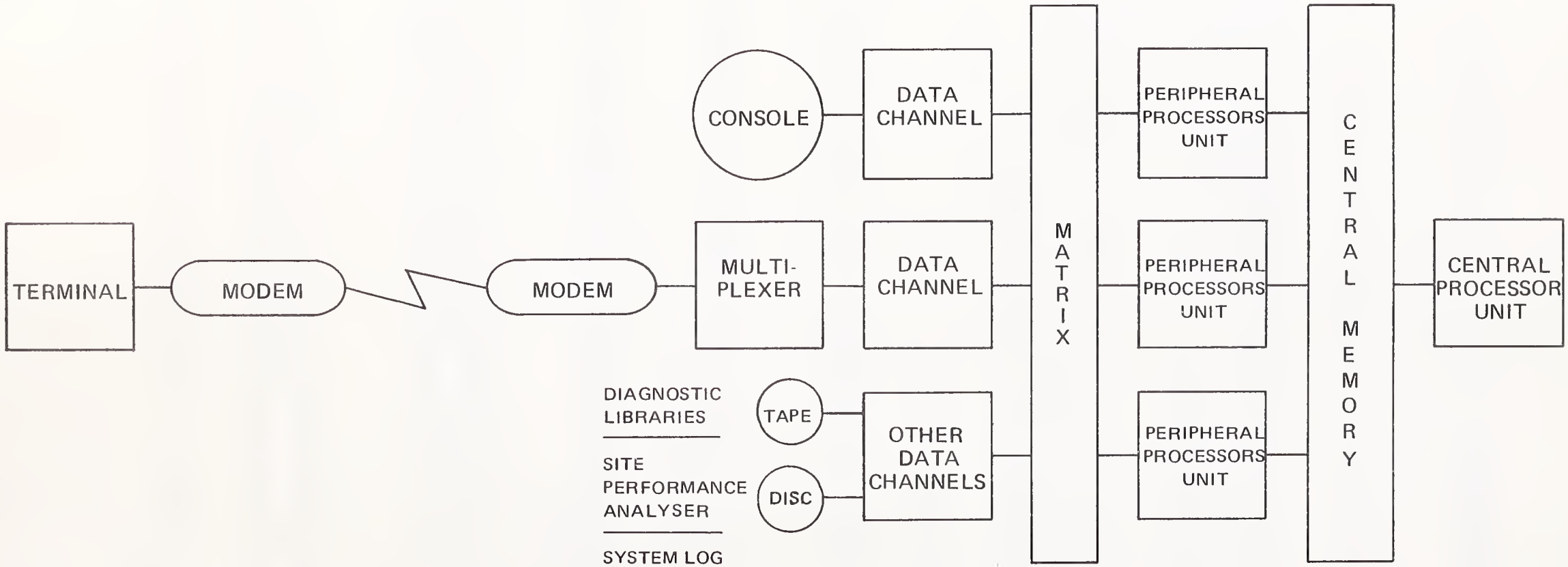
EXHIBIT III-6

REMOTE DIAGNOSTICS ON A DISTRIBUTED PROCESSOR



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- The user can prohibit the running of remote diagnostics by software procedures.

- Diagnostic routines can be run as a normal user job.

- The operator is notified of diagnostic procedures that could cause loss of data. The operator can then lock out again (by software) the user that may be affected.

3. SYSTEM OPERATION

- Exhibit III-7 illustrates the typical procedure for handling a fault call.

- During normal office hours, a user with a fault calls the local country 'war room'. The call is logged and the responsible field engineer informed.

- The field engineer uses remote diagnostics to interrogate the system's hardware performance analysor (HPA), Cyberlog and site performance analysor (SPA). These are a series of resident maintenance programmes within the normal operating system.

- Data held in these system files are made up of the following:

  - Cyberlog contains operator-entered data on system malfunctions, unscheduled deadstarts, degraded interruptions (i.e., tape failure) and comments on system performation.

  - Automatically logged data on system down interruptions, system degraded interruptions, event and lost times, party errors, retries, etc.

  - History files, containing system configurations and details of past performance, failures, mean time to fail, etc.

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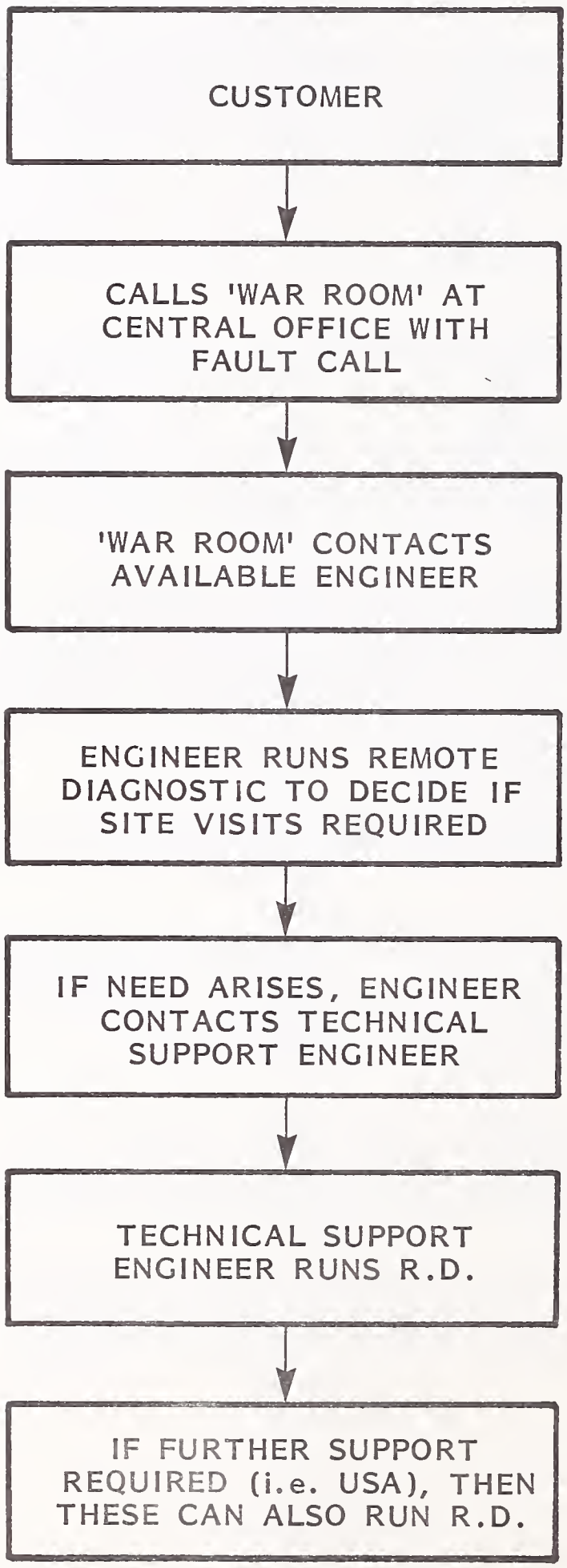
EXHIBIT III-7
CDC SYSTEM OPERATIONAL
PROCEDURE


CUSTOMER
CALLS 'WAR ROOM' AT CENTRAL OFFICE WITH FAULT CALL
'WAR ROOM' CONTACTS AVAILABLE ENGINEER
ENGINEER RUNS REMOTE DIAGNOSTIC TO DECIDE IF SITE VISITS REQUIRED
IF NEED ARISES, ENGINEER CONTACTS TECHNICAL SUPPORT ENGINEER
TECHNICAL SUPPORT ENGINEER RUNS R.D.
IF FURTHER SUPPORT REQUIRED (i.e. USA), THEN THESE CAN ALSO RUN R.D.

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- The field engineer can use portions of the concurrent maintenance library to exercise the system or subsystems, under the operating system, as a 'user'. The field engineer can request the operator to 'lock out' the other users at this time, thus ensuring the elimination of side effects to other system users.

- If required, the field engineer can take control of the whole system by informing the operator and then allowing the operator to clear the system of data and media. With the whole system, the field engineer is able to run any of the normal engineering maintenance programmes and receive status reports on his terminal. Voltage margin can also be run.

- Armed with this information, the field engineer can:

  - Arrange a site visit.

  - Organise the possible required spares.

  - Contact a technical specialist engineer for discussion of the problem. The technical specialist can also run the remote diagnostics from his own terminal, if required.

4. BENEFITS

- CDC's use of remote diagnostics within Europe had a slow start, due mainly to user resistance, but it is now gathering increasing acceptance.

- This is the first step in CDC's programme of remote system monitoring. The aim being:

  - To increase the mobility of the field engineer, moving away from the 'normal' CDC policy of on-site engineers.

  - To decentralise the workforce, with engineers being encouraged to work from home.

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- To improve system performance by 'seeing failures' before they become catastrophic.

- CDC currently reports that remote diagnostics have only had a marginal effect on the efficiency of its field engineers. This situation will improve as better use of the field engineer's time is made through the decentralisation and mobility of the workforce.

- No immediate restructuring of CDC's field engineering organisation is planned, but one is expected to occur within two or three years.

E. INTERNATIONAL BUSINESS MACHINES (IBM)

1. GENERAL

- IBM currently offers remote diagnostics, which it calls its support facility (RSF), on the 303X, 4300 and some associated I/O equipment.

- Prototype remote diagnostics were developed on the IBM 370-158 and formed the base for the 303X development. This list of equipment will be expanded to include the 8100 and future systems, but IBM would not say when.

- Remote diagnostics or RSF is offered as a customer option and no great pressure is placed on customers to take RSF. However, this feature is highlighted in IBM's sales literature, which claims that RSF can reduce system downtime.

- Further 'customer education' takes place prior to system installation to encourage taking this facility. It is only a matter of time before the option is removed and it becomes mandatory.

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- The software and hardware engineering functions are firmly split within IBM.

  - Software problems are dealt with by the software support organisation, which is structured as illustrated in Exhibit III-8.

  - Hardware problems are handled by the local CE organisation, with assistance via remote diagnostics from the hardware support center.

  - The two centers are not the same, and in the case of the U.K., they are some 200 km apart.

- Cost for the additional equipment, modem and telephone line is split. Normally the customer pays for the installation of a modem and line while IBM pays the rental charges of the line.

- No reduction in maintenance charges is given for taking the remote diagnostic facility.

2. SYSTEM COMPONENTS (EXAMPLE 303X)

- The standalone dual display console (3036) has a secondary function as the service support station.

- The console is controlled by two interchangeable microprocessors, each with its own CRT, keyboard, floppy disc and I/O interface channel.

  - One processor is used for process control programme interaction and is referred to as the operator station.

  - The other processor is used mainly for the service function and is referred to as the service support station. This service support station can display the status of the system and log errors, system failures and similar faults. It is also used for running the diagnostic programmes.

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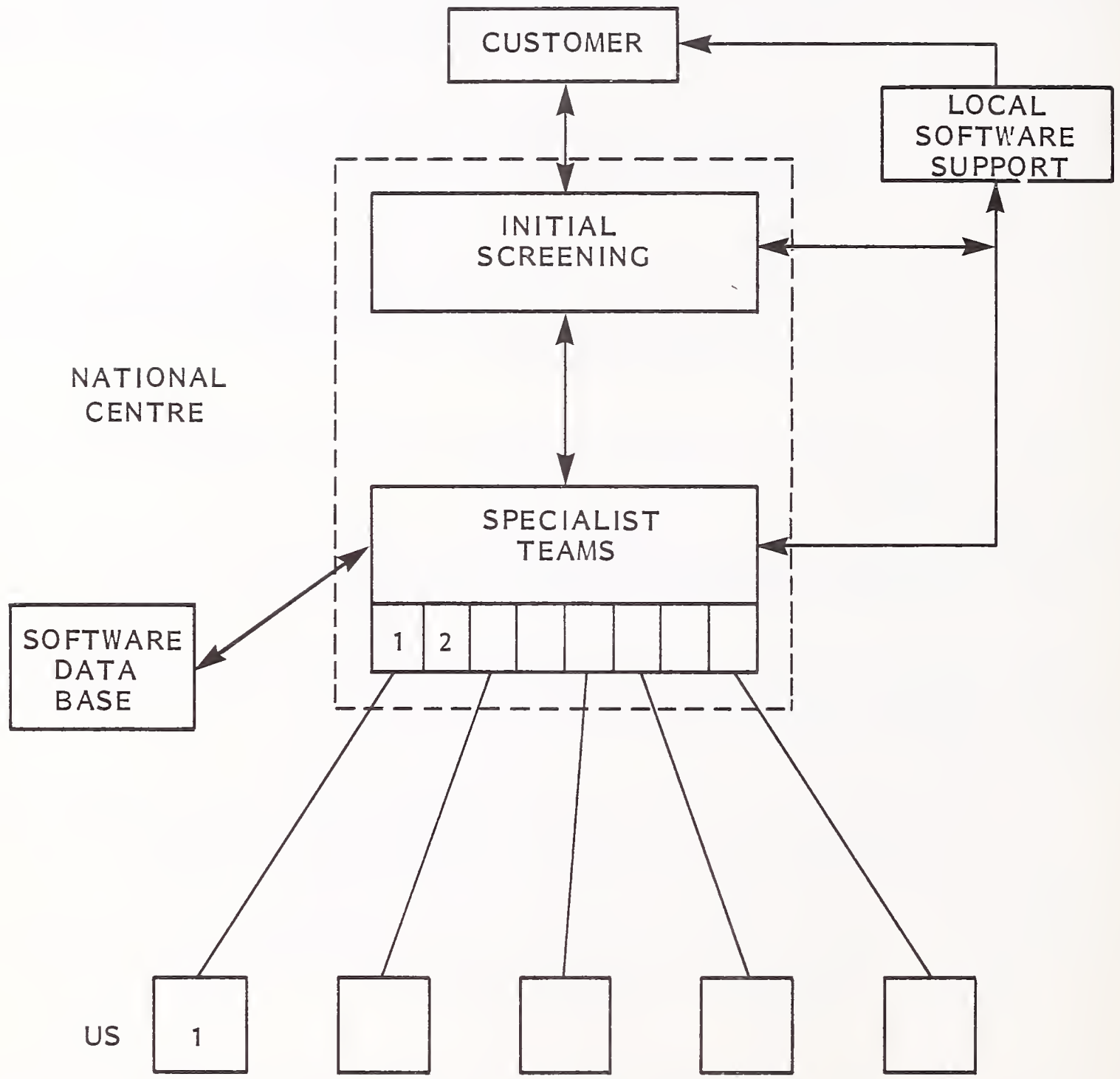
EXHIBIT III-8

IBM SOFTWARE SUPPORT
ORGANISATION



CHANGE TEAMS

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- The 3036 console can be connected, via a modem and a teleprocessing link operating at 1,200 baud, to the IBM 'retain' system, which is a worldwide database support service.

- The RETAIN system database contains:

  - Information on fault symptoms.

  - Fixes.

  - Service techniques.

  - Engineering changes.

  - Customer log transfer option.

  - Remote console option.

- The last two form the basis of the remote diagnostics RSF feature offered by IBM.

- Customer log transfer option.

  - With the permission of the customer and engineer, this option connects the customer system to RETAIN and transfers the system logs onto the RETAIN database.

  - Transfer of logs has no effect on the operating system and can be done with no disruption.

  - Once on the RETAIN database, the log can be reviewed 'at leasure' by specialist engineers. These engineers can either be locally, nationally or internationally located. Each inspection is recorded.

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- Remote console option.

  - This is by far the more powerful of the two options, as it allows a remote engineer to operate the diagnostic system.

  - This option requires that the entire system is dedicated to diagnostics, and allows the remote engineer to act as if he were located on-site.

  - The remote C.E. may:

    . System reset.

    . Clear memory.

    . Step single cycle.

    . Perform on-line tests.

    . Measure voltages.

    . Check system status indicators.

    . Display logs.

  - Concurrently the data banks can be searched for similar fault records, etc.

  - Once a fault is fixed, the RETAIN incident log is updated and, if applicable, the RETAIN database has this information added.

3. SYSTEM OPERATION

- Exhibit III-9 shows the IBM RETAIN system in schematic form.

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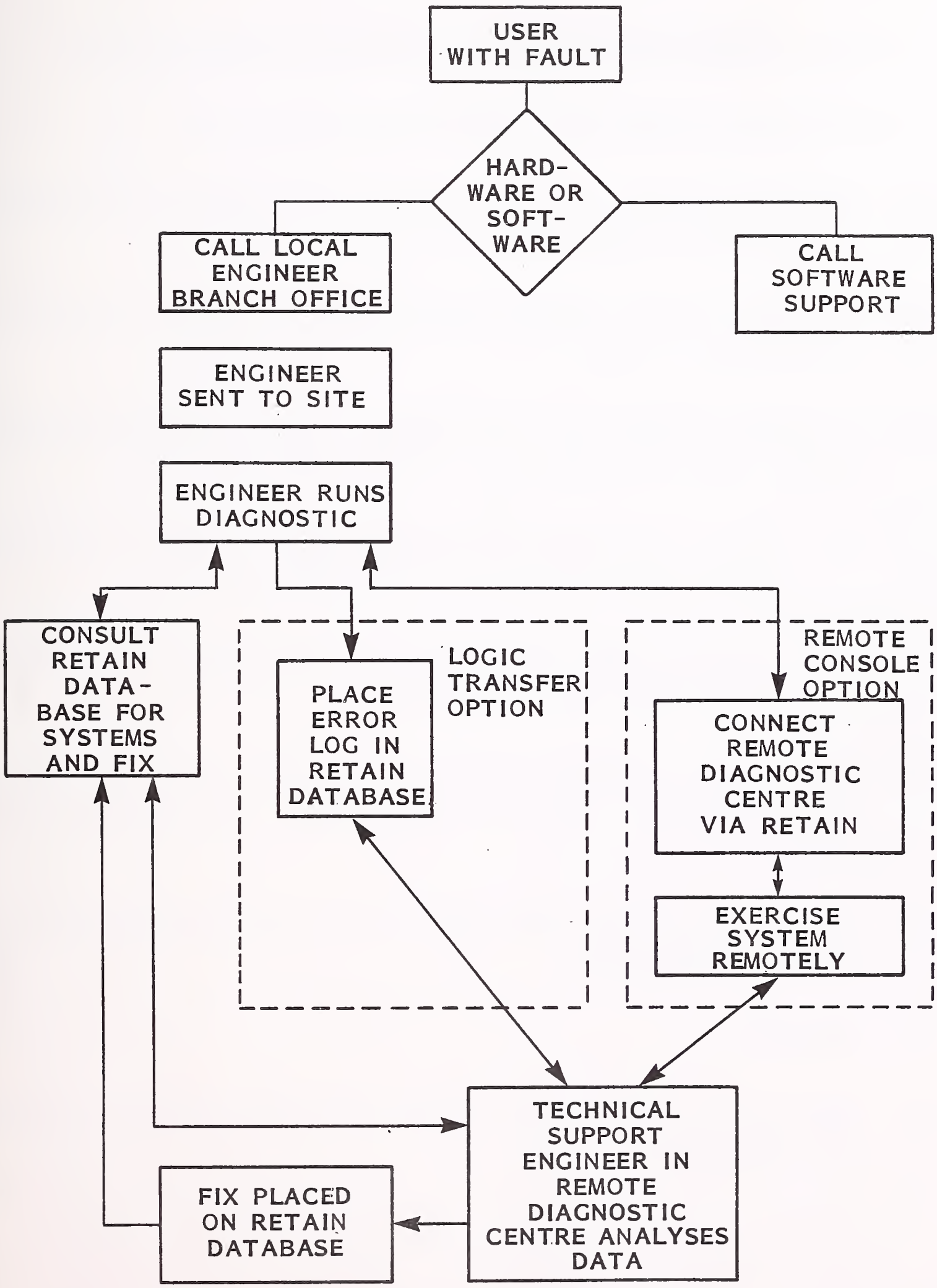
EXHIBIT III-9

RETAIN SYSTEM SCHEMATIC


USER WITH FAULT
HARD-WARE OR SOFT-WARE
CALL LOCAL ENGINEER BRANCH OFFICE
CALL SOFTWARE SUPPORT
ENGINEER SENT TO SITE
ENGINEER RUNS DIAGNOSTIC
CONSULT RETAIN DATA-BASE FOR SYSTEMS AND FIX
LOGIC TRANSFER OPTION
PLACE ERROR LOG IN RETAIN DATABASE
REMOTE CONSOLE OPTION
CONNECT REMOTE DIAGNOSTIC CENTRE VIA RETAIN
EXERCISE SYSTEM REMOTELY
TECHNICAL SUPPORT ENGINEER IN REMOTE DIAGNOSTIC CENTRE ANALYSES DATA
FIX PLACED ON RETAIN DATABASE

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- A customer with a problem must first decide if it is a software or hardware failure.

  - If software, he calls his national software support service center.

  - If hardware, he calls the local branch office.

- Hardware problems are reported to the local branch office, which dispatches an engineer to the local customer site.

- Once the engineer is on-site, depending on the problem, he may invoke the remote diagnostic facility.

- The engineer contacts the national hardware support center and discusses the problem with a technical specialist. It may be decided:

  - To take the system log into retain so allowing analysis of data while system continues to operate in a possibly degraded mode.

  - To have the technical specialist take control of the system via the remote console option within retain.

- If the problem is unresolved, the same remote diagnostic option is available to other internationally based technical specialist or manufacturing plant engineers.

- Once fixed, the RETAIN incident log is updated, and the local engineer returns the system to the customer.

4. BENEFITS

- IBM has a very powerful tool by combining the effective RETAIN system and remote diagnostics.

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- A number of benefits result from using remote diagnostics as a tool for the on-site engineer:

  - No travel time is required for special technical support engineers.

  - Immediate involvement of the support engineer reduces downtime.

  - Efficiency of on-site engineer is increased, as he has early support, allowing him to move on to the next problem quickly.

  - Taking copy of error logs into RETAIN allows various people to work on the problem.

  - Backup support from plant or internationally based engineers is immediately available.

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IV RESULTS OF THE VENDOR SURVEY

IV RESULTS OF THE VENDOR SURVEY

A. GENERAL

- Of the 21 vendors interviewed, only one was not planning, or did not have, any form of remote diagnostics.

  - The reason given for this company's lack of interest was that feedback from other vendors is negative and that 'it just doesn't work'. INPUT's experience and research in preparing this report was quite the opposite. For example, other vendors' quotations included:

    . 'Distribution of expertise.'

    . 'Resident engineers are very expensive.'

    . 'Reduce labour costs.'

    . 'Improve the service.'

    . 'Standard service response should be key for our industry.'

    . 'Our engineers need help.'

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- 'Can't get a stable on-site population.'
- 'Reduce shift cover problems.'
- 'Labour saving.'
- 'Improve our profitability.'
- 'Improve response.'
- 'Lack of good engineers.'

- Of the 20 vendors committed to remote diagnostics:
  - Thirteen vendors are currently using some form of remote diagnostics.
  - Six vendors are planning to implement remote diagnostics by the end of 1981.
  - One vendor was planning to be operational by late 1982. To quote, 'We were a bit slow off the mark on realising the potential of remote diagnostics.'

- Exhibit IV-1 illustrates the degree of importance that vendors place on remote diagnostics. Vendors that have remote diagnostics generally gave higher rankings than those vendors planning its implementation.
  - This same trend is reflected in vendors' commitment to implementation and the sales/marketing department's acceptance of remote diagnostics, as shown in Exhibits IV-2 and IV-3.

- DEC is the only company found by INPUT that was actively 'selling' remote diagnostics. Other vendors simply mention the remote diagnostic capabilities in system sales literature.

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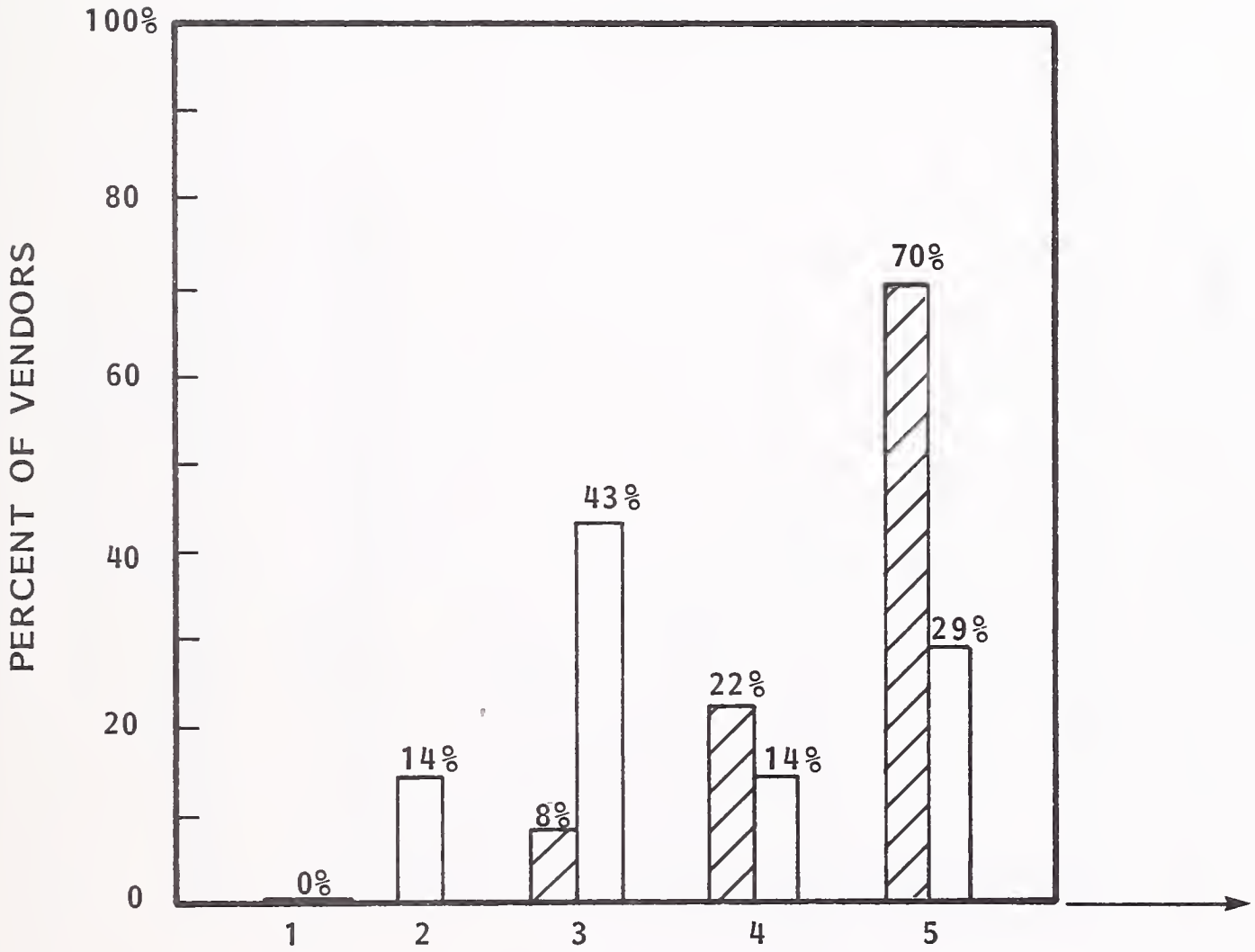
EXHIBIT IV-1

IMPORTANCE OF REMOTE DIAGNOSTICS TO VENDOR RESPONDENTS



VENDORS PLANNING R.D.

VENDORS WITH R.D.

NUMBER OF RESPONSES = 21

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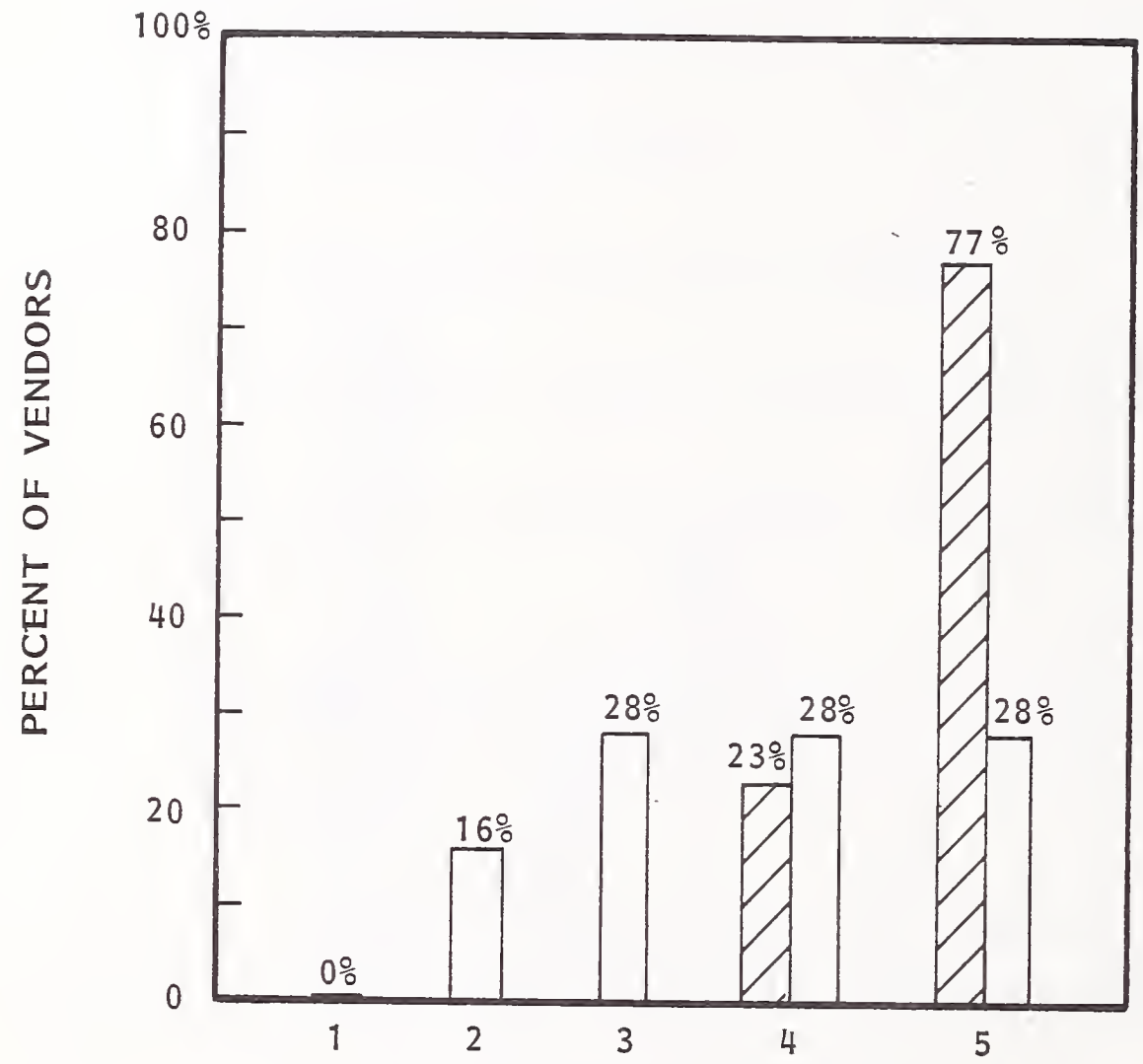
EXHIBIT IV-2

VENDORS'
COMMITMENT TO IMPLEMENT
REMOTE DIAGNOSTICS



VENDORS PLANNING R.D.

VENDORS WITH R.D.

NUMBER OF RESPONSES = 21

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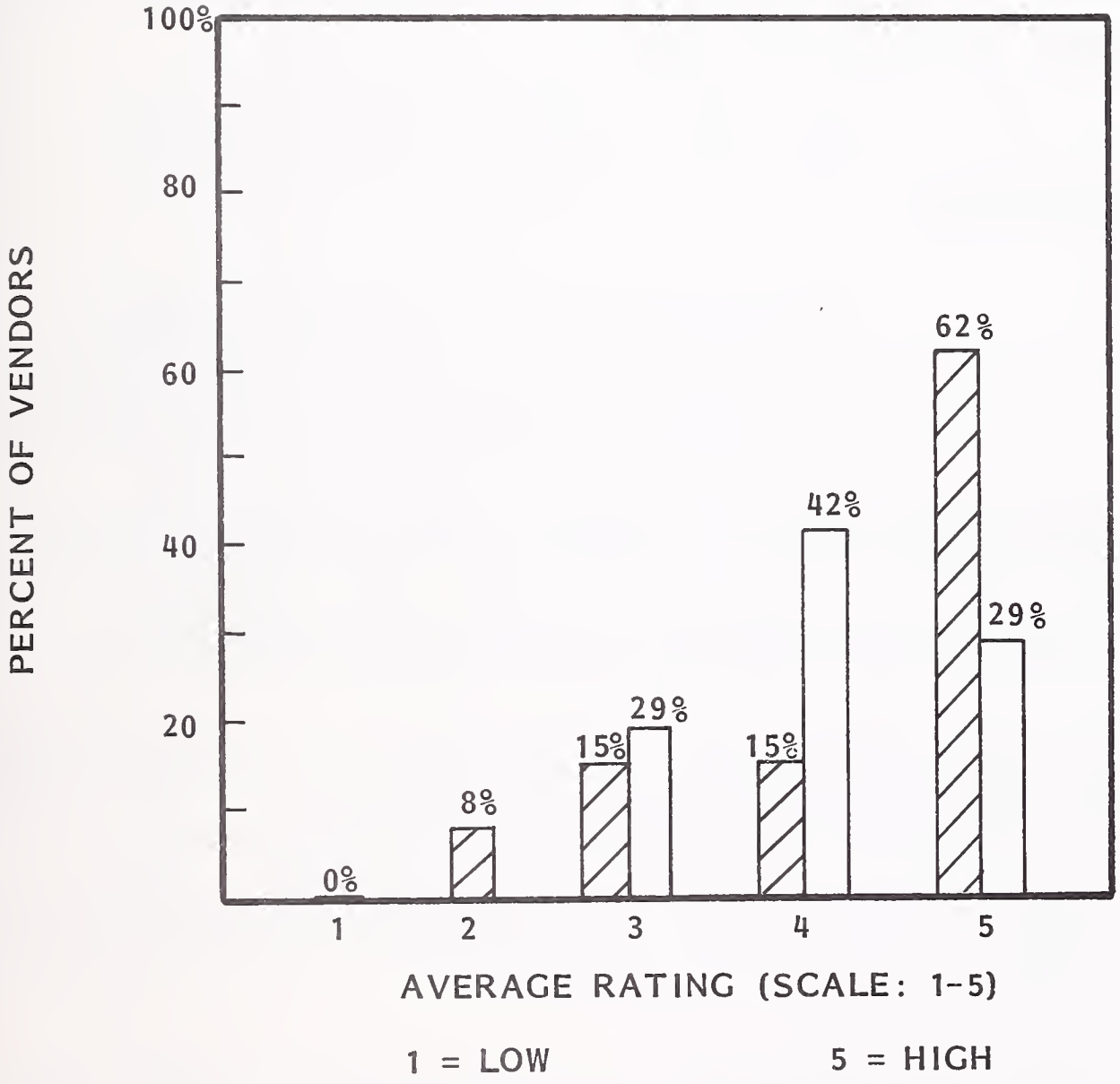
EXHIBIT IV-3

SALES/MARKETING ACCEPTANCE OF
REMOTE DIAGNOSTICS



VENDORS PLANNING R.D.

VENDORS WITH R.D.

NUMBER OF RESPONSES = 21

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- Most sales and marketing organisations in vendor companies have not yet fully appreciated the potential of this feature as a sales and marketing tool.

  - Vendors promote remote diagnostics as an extra tool for the engineer instead of stressing user benefits. However, few users are concerned with solving the vendors' operating difficulties. They want to know what remote diagnostics will do for them.

- Nixdorf has officially launched its remote diagnostics, and initial reaction in the trade press has been favourable.

B. DATA SECURITY

- Many vendors expected and have experienced concern from users regarding data security. However, vendors have partially overcome these problems by:

  - Giving users control over security by mechanical lock-out switches.

  - Allowing the user to lock out remote diagnostics via software.

  - Providing procedures that ensure all user data are either removed or write-protected during diagnostic procedures.

  - Having procedures that require agreement from the operator/shift leader prior to remote diagnostic hook-up.

- One vendor's attitude toward the security of user data was rather surprising: 'It's their problem, not mine!'

- One vendor reported that his users had expressed concern which disappeared once the remote diagnostics system was operational.

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- Only one vendor admitted to causing a loss of data at a user site when he overwrote a system disc. Average care could have avoided the embarrassment.

- Some vendors give a warning that remote diagnostics are to be run and allow the user a limited time (e.g., two to five minutes) to remove data media.

- Obviously, some top security sites will never allow remote access under any circumstances.

- It must be remembered that the field engineer is often still at the bottom of the learning curve regarding remote diagnostics, and that errors will occur.

C. EFFECTIVENESS OF REMOTE DIAGNOSTICS

- Fault detection rates varied from 30-90%. The majority of vendors (71%) expected to detect over 70% of the problems, while 43% expected to find greater than 95%, without an on-site visit. Of the fault calls, vendors reported that 20-30% could be fixed without an on-site visit.

- Detection rates for software problems were significantly lower. Only 40% of vendor respondents expected to detect more than 50% of the software faults. Once detected, however, over 75% could be fixed without the need of an on-site visit.

D. PTT PROBLEMS

- The PTTs in Europe, renowned for their ineptitude, have not proved such a problem as first expected. Perhaps vendors are learning to live with the situation!

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- Luck plays a major part in dealing with the PTT: the German PTT proving the most efficient, the French the most notorious and the British the most inept.

- The transborder data flow issues, such as those being introduced by Germany in 1981, are not envisaged to impact remote diagnostics.

- Twenty vendor respondents used dial-up through public-switched networks. One used a hard-wire direct connection.

- Only eight vendors had experienced problems with PTTs, and most of these were frustrations caused by the time taken to obtain equipment, lines and approvals.

- Fifty-five percent of the vendors interviewed were operating at 1,200 baud. Twenty-two percent were operating at 9,600 baud, while the rest used 300 baud. As most European PTTs only guarantee the 1,200 baud rate, those operating at 9,600 baud were at 'risk'.

  - Most vendors would prefer to operate at a guaranteed baud rate of 9,600.

  - Vendors would prefer a dedicated data link, but this approach is prohibited by high costs.

  - One vendor complained of the very low speeds available in rural areas of France - 110 baud!

  - To quote one vendor about the German PTT, 'They have done an outstanding job in areas within their control.'

  - The time taken for the PTT to approve equipment, and the slow delivery of modems, are major frustrations throughout most of Europe.

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- Of the U.K. PTT, one vendor stated, 'They have a paranoiac resistance to unknown equipment.'

- Sixty-nine percent of the vendors interviewed had the capability to down-load software, but with limited baud rates, this facility is not being used to its full.

E. EFFECTS ON THE STRUCTURE OF VENDOR ORGANISATIONS

- Fifty percent of vendors with remote diagnostics have experienced internal organisation changes since adoption.

  - The major change has been the setting up of remote diagnostic centers. Ninety-two percent of vendors who now offer remote diagnostics have established at least one center. Of the vendors planning remote diagnostics, 71% expect to set up such a center.

- No vendor has experienced a major problem with acceptance by their field engineers. But to quote one engineering manager, 'They don't known what's hit them yet!' He expects to provide less training and fewer incentives to his field engineers.

- INPUT agrees that field engineers have not yet fully assessed the effects of remote diagnostics. It is clear that engineering organisations will undergo some radical changes in the next five years.

  - The quality and expertise of the average field engineer will fall.

  - Remote diagnostics will breed a super engineer and widen the gap between the field engineer and technical support engineer. To some extent, it has been the lack of suitable engineering material that has accelerated the implementation of remote diagnostics.

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- The traditional incentive to the field engineer - training on the latest equipment - will decrease.

F. MANAGEMENT REPORTING

- Only one vendor had no management reporting capability in his remote diagnostics system, but he is planning to add this in 1981.

- Most systems provide reporting of:

  - Mean time between failures.

  - Mean time to respond.

  - Mean time to repair.

- Some vendors are expanding the reporting to include data relating to:

  - Efficiency of engineers.

  - Efficiency of the remote diagnostic center.

  - Service levels to customer.

  - Spares usage.

- Remote diagnostics will relieve some of the reporting currently carried out by field engineers, which is always a problem. This will give a more honest picture of field engineer efficiency, since few accurately report dead time. With improved reporting and a clear view of field engineer activity, a savings in staffing levels will be possible.

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G. EFFICIENCY OF FIELD ENGINEERS

- Fifty percent of the vendors with remote diagnostics reported an increase of efficiency of the field engineers associated with its use.

  - The average increase was 15%.

- The other 50% reported that the efficiency of the field engineer had stayed the same.

- One vendor reported that he had no idea, but 'hoped' it was better. A need for greater management reporting and awareness was very apparent in this case!

- If the expected cost savings in the use of remote diagnostics are to be made, they must come through improving the efficiency of the field engineer to ensure revenue-per-person increases.

H. DEVELOPMENT

- The majority of vendors have left or are nearing the end of the development stage in remote diagnostics.

- Of the 20 vendors planning or using remote diagnostics, only five were developed in Europe. The rest are using or adapting a system imported from the U.S.

- Multinational companies with corporate headquarters in the U.S. inherit the U.S. system and are adapting as necessary to suit European requirements.

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V USER REACTIONS TO REMOTE DIAGNOSTICS

V USER REACTIONS TO REMOTE DIAGNOSTICS

A. SURVEY OBJECTIVES AND PROFILE

- Despite manufacturers' claims, the use of remote diagnostics in Europe is so new that very few users have had any opportunity to calibrate or measure its effectiveness.

- With this fact in mind, INPUT conducted a qualitative survey across a broad spectrum of users with the following major objectives:

  - To assess users' a priori acceptance of the introduction of remote diagnostics.

  - To determine how users expect the availability of remote diagnostics to offset what they pay for maintenance.

  - To define potential problems so that vendors can develop plans to alleviate them before introduction.

  - To compare attitudes between those who have used remote diagnostics and those who have not.

- Of 49 companies interviewed:

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- Seventeen stated that their suppliers did not offer remote diagnostics.

- Thirty-two stated that their suppliers did offer remote diagnostics.

  . Of these, 15 said that they didn't use them.

- In all cases, interviews were held with user operations personnel who had a direct interface with vendor maintenance activities.

- Users were intentionally selected with a heavy focus on DEC and IBM because those firms have the most active remote diagnostic programme. The distribution of hardware vendor mentions in the interview sample is given in Exhibit V-1.

B. ATTITUDES OF NON-USERS

- Of the 32 respondents who did not use remote diagnostics, the general reaction could be described as one of cautious optimism.

- Most users realize they have no choice. If remote diagnostics are an integral part of the vendor's maintenance programme, they will get it whether they want it or not.

- However, reactions varied widely. Examples of typical comments received were:

  . 'Sounds bloody good.'

  . 'Inevitable.'

  . 'Could be useful.'

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EXHIBIT V-1

USER SURVEY HARDWARE VENDORS

VENDOR	NUMBER OF MENTIONS
AMDAHL	2
BURROUGHS	4
CASE	1
CII/HONEYWELL	3
DATA GENERAL	1
DEC	20
GENERAL AUTOMATION	1
HEWLETT-PACKARD	2
IBM	14
ICL	4
MAGNUSON	1
MEMOREX	1
PHILIPS	1
PRIME	2
RACAL	2
SIEMENS	1
UNIVAC	3

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. 'Interesting concept.'

. 'OK, if it doesn't cost more.'

- As shown in Exhibit V-2, a great majority of non-users were favourably disposed to using remote diagnostics. Some 61% could be described as enthusiastic about the possibility.

  - When virtually the same question was put to them in a different way - namely, 'how willing are you to cooperate with vendors' - the results were even more positive, as shown in Exhibit V-3.

- Clearly, most users are ready and willing to have remote diagnostics used in their facilities.

  - To some extent, this is in opposition to the results obtained from INPUT's research in the U.S., which shows that users are extremely wary of vendors trying new maintenance techniques on their installations. (See INPUT's 'User Self-Maintenance' report, published August 1980).

  - Multinational vendors should be aware of this difference. Most remote diagnostics systems have been and are being developed and tested in the U.S. The results of this study indicate that, all things being equal, Europe would serve as a better test bed for any new system introduction.

- Even so, that European users do have some significant concerns about the use of remote diagnostics which vendors must address in both a marketing as well as a technical sense.

  - Exhibit V-4 shows that 80% of non-users are concerned with the possible infringement of data security. Several people interviewed stated that they would not permit the use of remote diagnostics until

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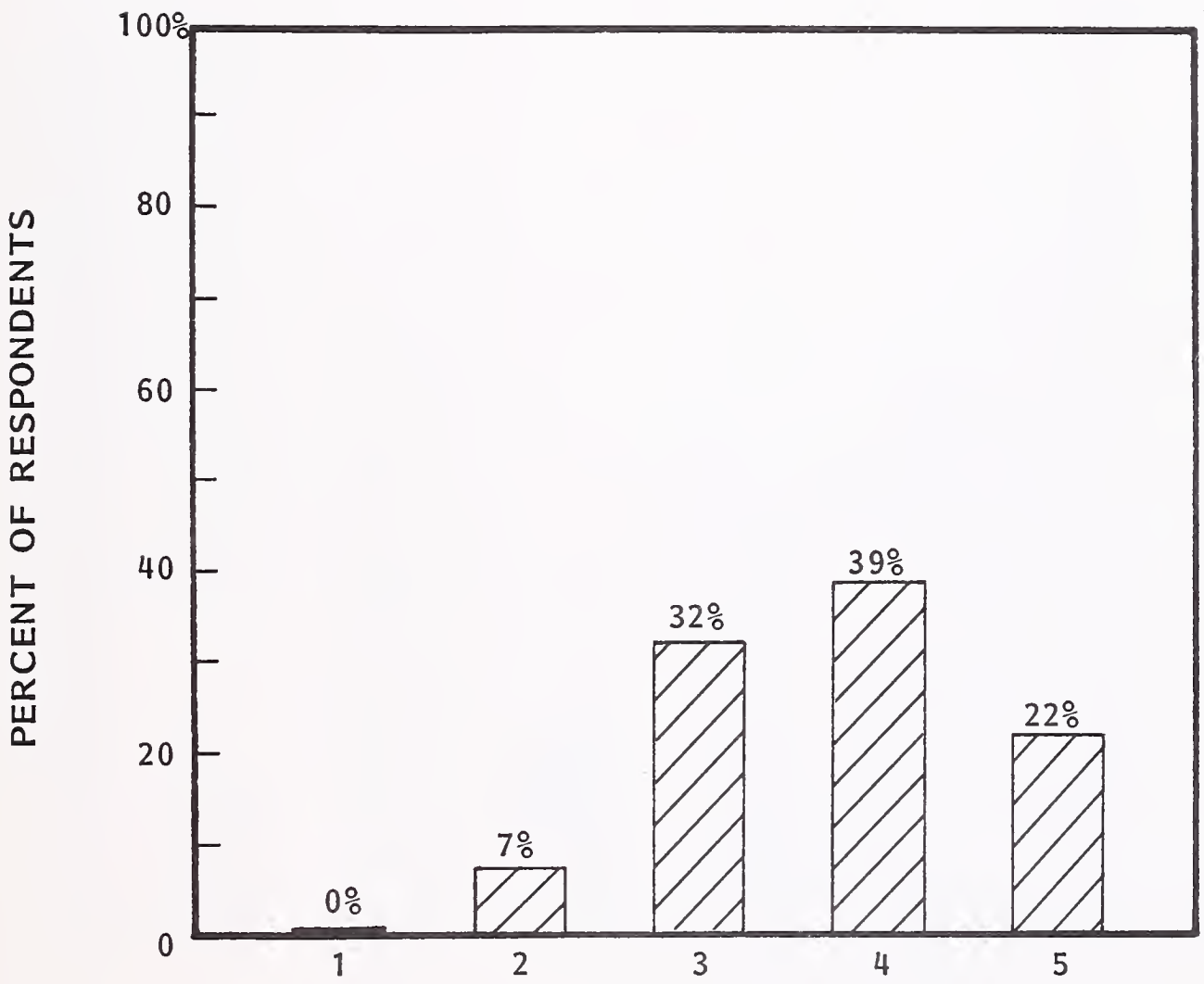
EXHIBIT V-2

NON-USERS'
WILLINGNESS TO USE REMOTE DIAGNOSTICS



NUMBER OF RESPONSES = 28

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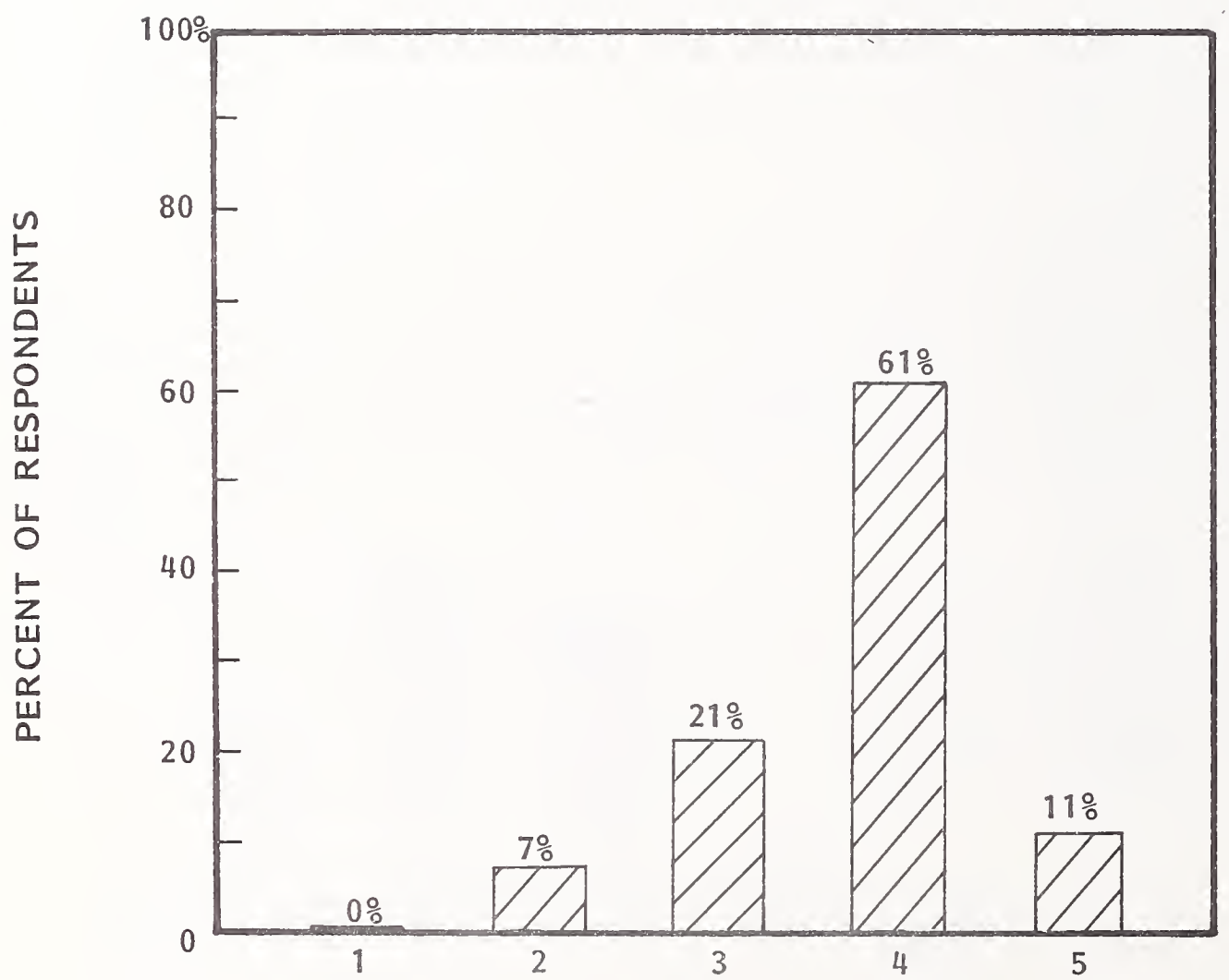
EXHIBIT V-3

NON-USERS'
WILLINGNESS TO COOPERATE WITH VENDORS
ON INTRODUCTION OF REMOTE DIAGNOSTICS



NUMBER OF RESPONSES = 28

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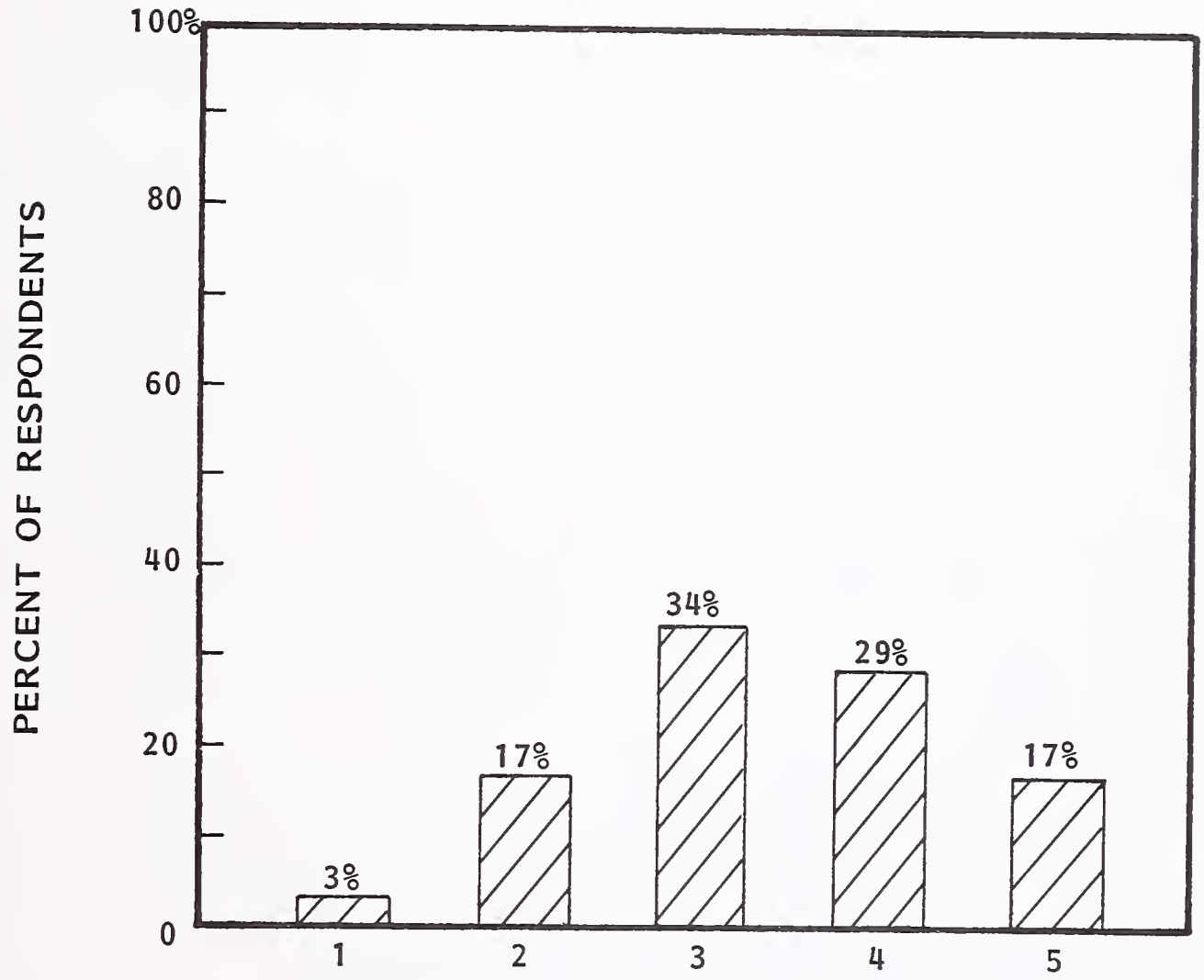
EXHIBIT V-4

NON-USERS'
DEGREE OF CONCERN WITH DATA SECURITY



NUMBER OF RESPONSES = 29

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the vendor could adequately demonstrate that their data was completely secure.

- A second major concern expressed by the users surveyed was that of losing data during the exercise of a remote diagnostic procedure, as shown in Exhibit V-5.

- Examples of statements made by interviewees are:

  . 'Must maintain control at our end.'

  . 'We must have guarantees from vendor on all aspects of data security.'

  . 'Vendors must provide fail-safe systems to prevent interaction.'

  . 'No problem as long as they don't get at our sales figures.'

  . 'There can be no external access to our proprietary software.'

- Users surveyed also expressed a high degree of concern with what they perceive as diminished direct contact with engineers as a result of having remote diagnostics. Responses are tabulated in Exhibit V-6.

- Non-users were asked to comment on how willing they would be to participate in replacing defective modules if a problem were detected by remote diagnostics. As shown in Exhibit V-7, there is a reasonably high degree of acceptance on this subject. This result bears out earlier research (1979) which also showed a high receptivity on the part of Europeans to participating in the maintenance activity.

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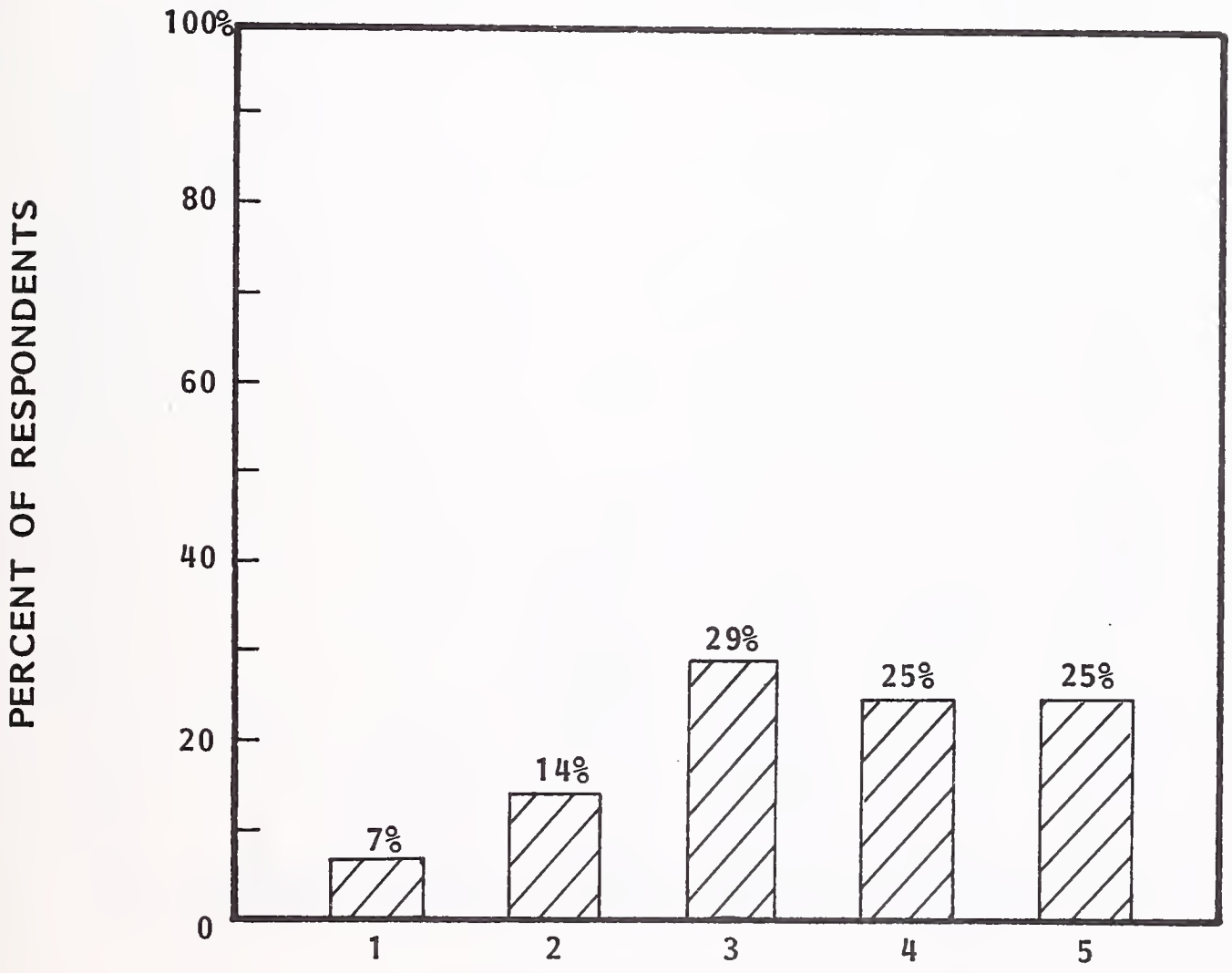
EXHIBIT V-5

NON-USERS'
DEGREE OF CONCERN FOR DATA LOSSES
CAUSED BY EXERCISE OF REMOTE DIAGNOSTICS



NUMBER OF RESPONSES = 28

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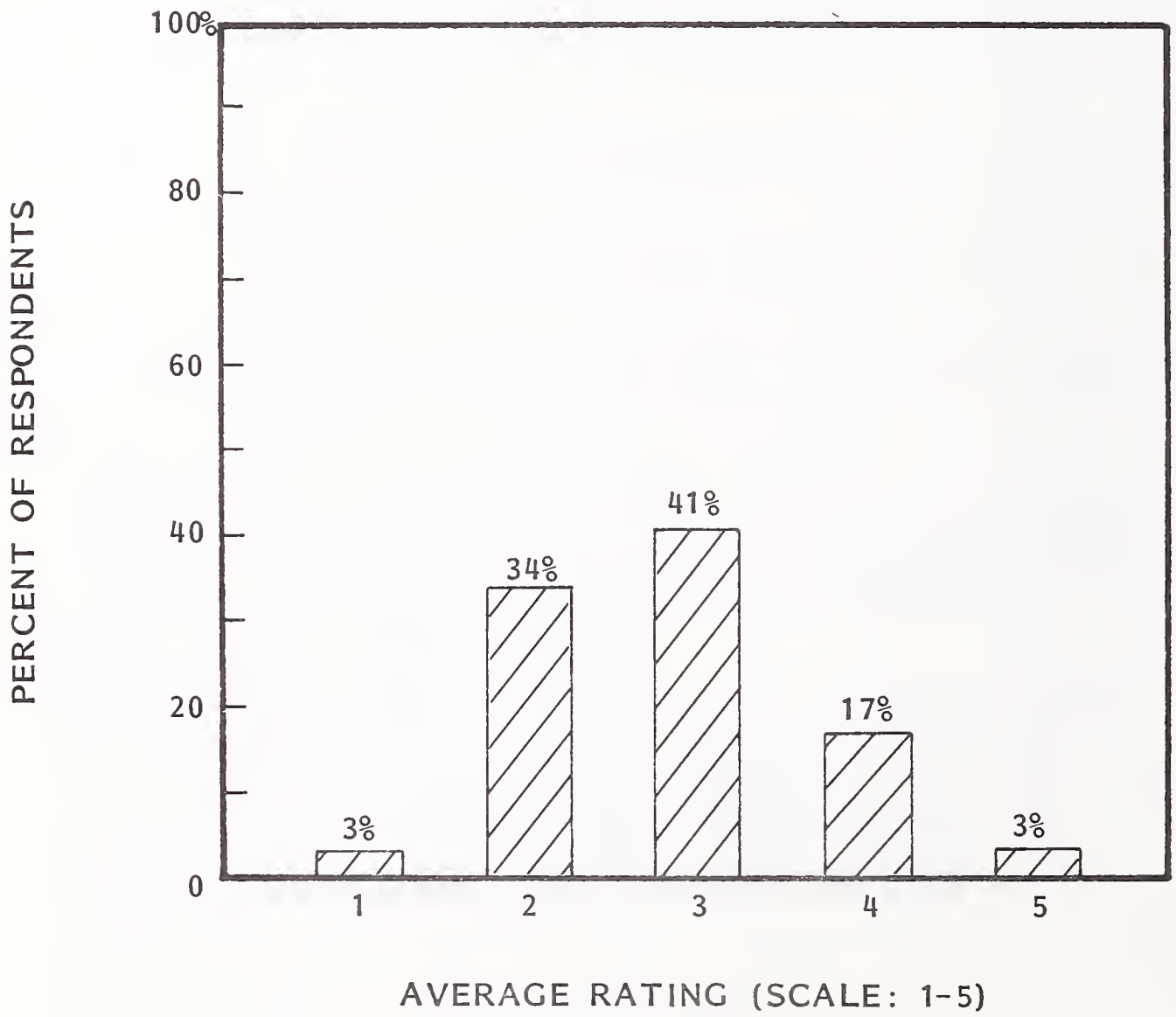
EXHIBIT V-6

NON-USERS'
DEGREE OF CONCERN FOR DIMINISHED
DIRECT CONTACT WITH FIELD SERVICE ENGINEERS



NUMBER OF RESPONSES = 29

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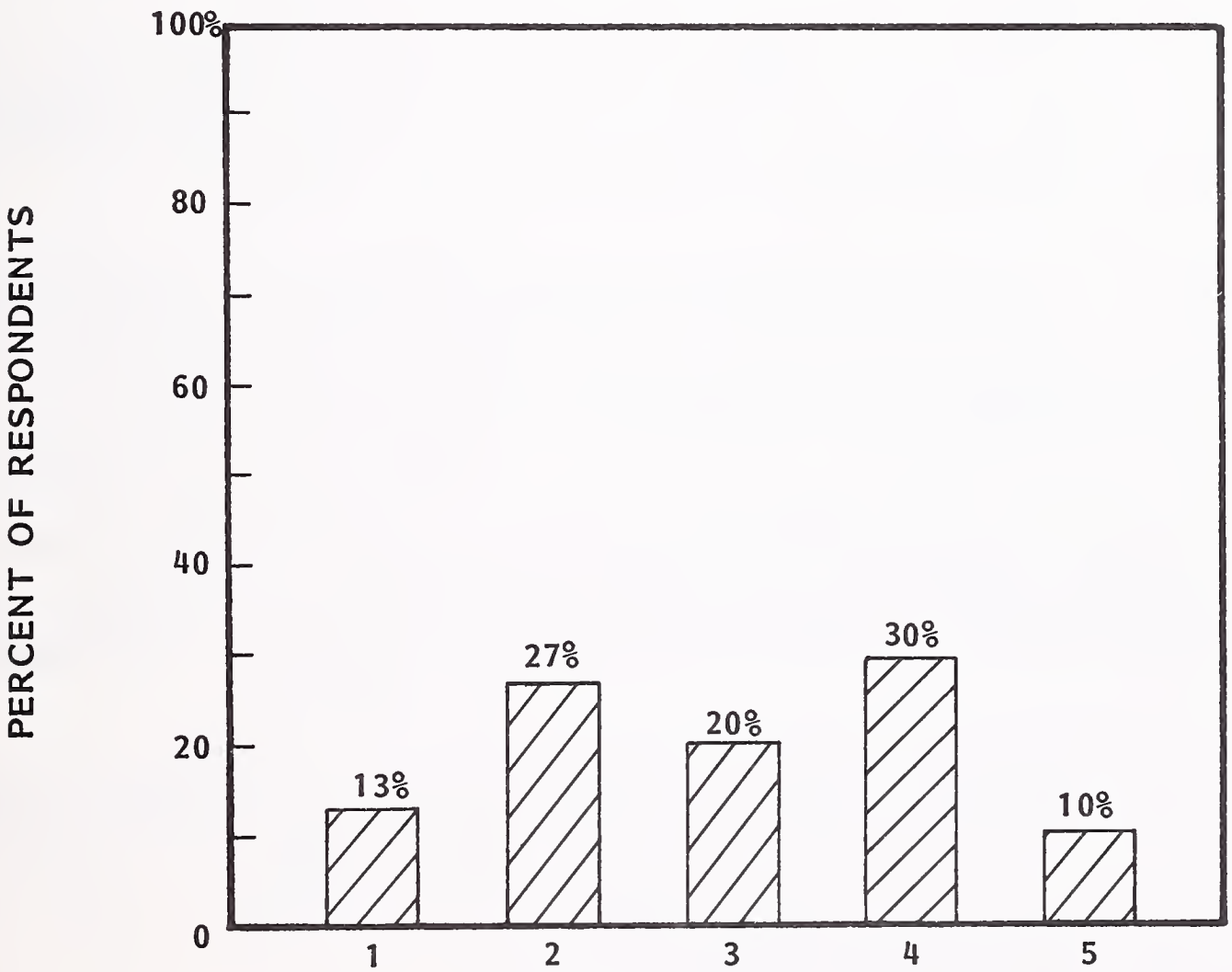
EXHIBIT V-7

NON-USERS' DEGREE OF WILLINGNESS TO ALLOW OPERATOR
TO CARRY OUT BOARD/MODULE REPLACEMENT
IF PROBLEM DETECTED BY REMOTE DIAGNOSTICS



NUMBER OF RESPONSES = 30

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- The results of a survey of 912 users in the U.S. showed that only 14% were willing to consider performing physical maintenance tasks. Again, this suggests that different policies between the U.S. and Europe should be evaluated closely by multinational vendors.

- Exhibit V-8 illustrates non-users' perceptions of the impact of remote diagnostics on a variety of maintenance issues.

  - Overall, non-users expect that remote diagnostics will improve system availability and reduce meantime to respond and repair.

  - Most non-users expect that the quality of their customer engineers will not change as a result of remote diagnostics. However, about 75% felt the quality would decrease, as remote diagnostics would ultimately obviate the need for highly skilled people in the field.

  - Finally, the majority of users expect maintenance charges to <u>decrease</u> with the introduction of remote diagnostics, or, if they did not actually go down, most users expect them at least not to increase.

- In order to obtain a qualitative calibration on the survey group, non-users were asked to comment on their present level of satisfaction with their maintenance services, and where they see it going in the future.

  - As shown in Exhibits V-9 and V-10, most are generally pleased with their present service and expect that future service levels will continue to be satisfactory or improved. Respondents who were dissatisfied with their present service were, in general, the same ones who expected service to get worse.

- As noted earlier, of the 32 respondents not using remote diagnostics, 17 had systems that could theoretically have used it because the service was available from the supplier. The primary reason given for not using it was that the supplier had not yet 'got around to selling it to us'. This state of affairs

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EXHIBIT V-8

IMPACT OF REMOTE DIAGNOSTICS
AS PERCEIVED BY NON-USERS

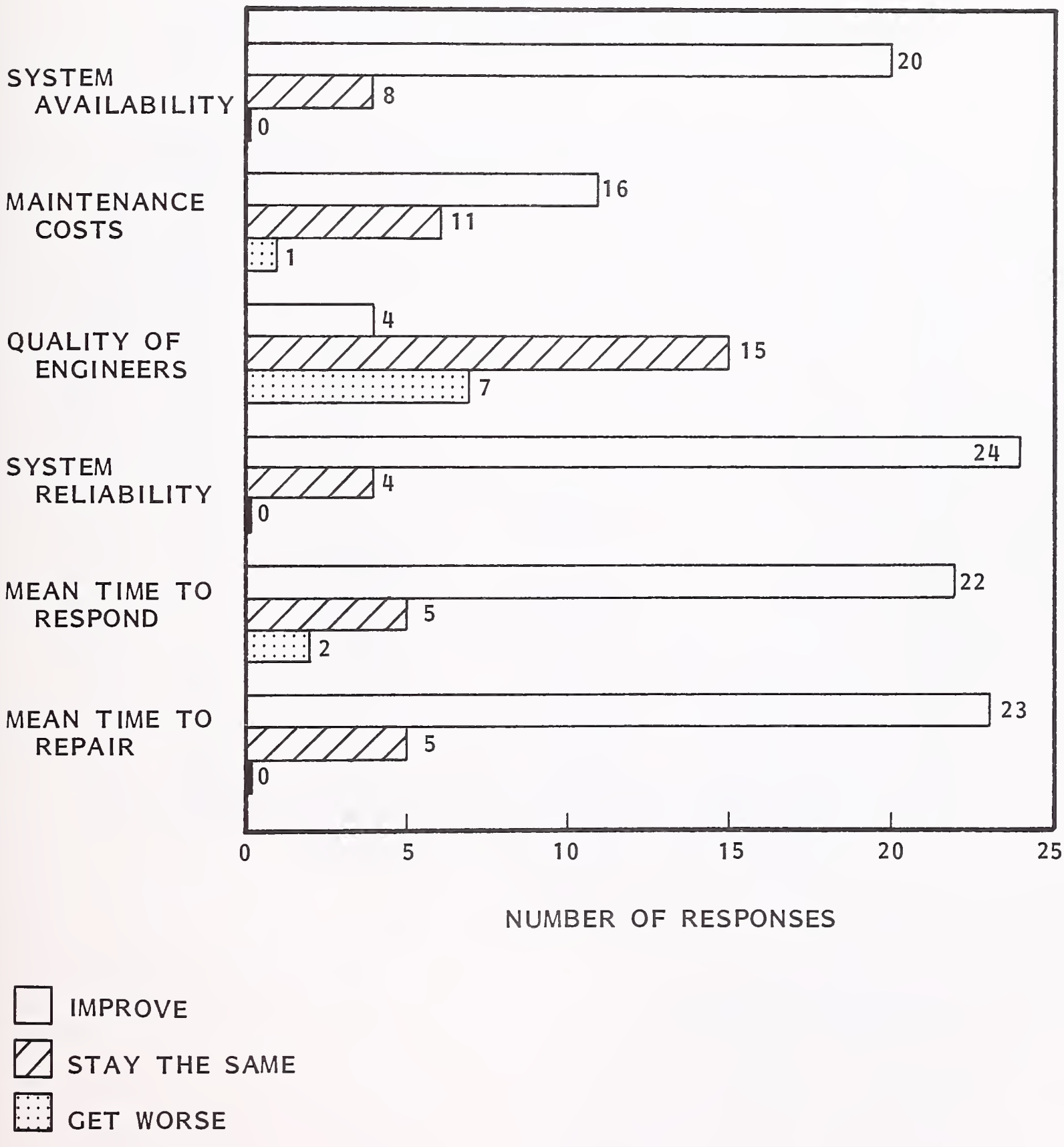

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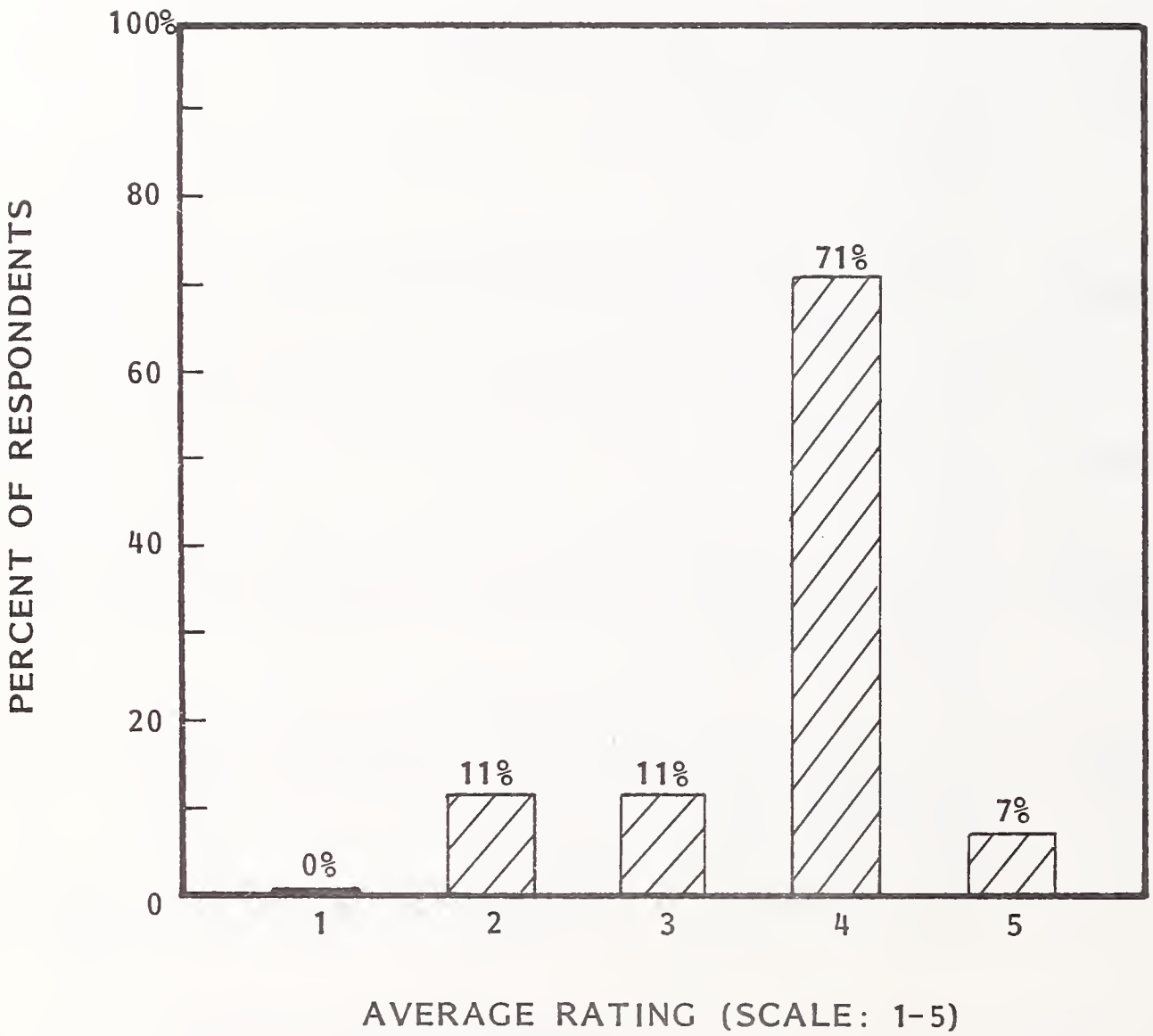
EXHIBIT V-9

NON-USERS'
SATISFACTION WITH CURRENT
MAINTENANCE SERVICE



NUMBER OF RESPONSES = 28

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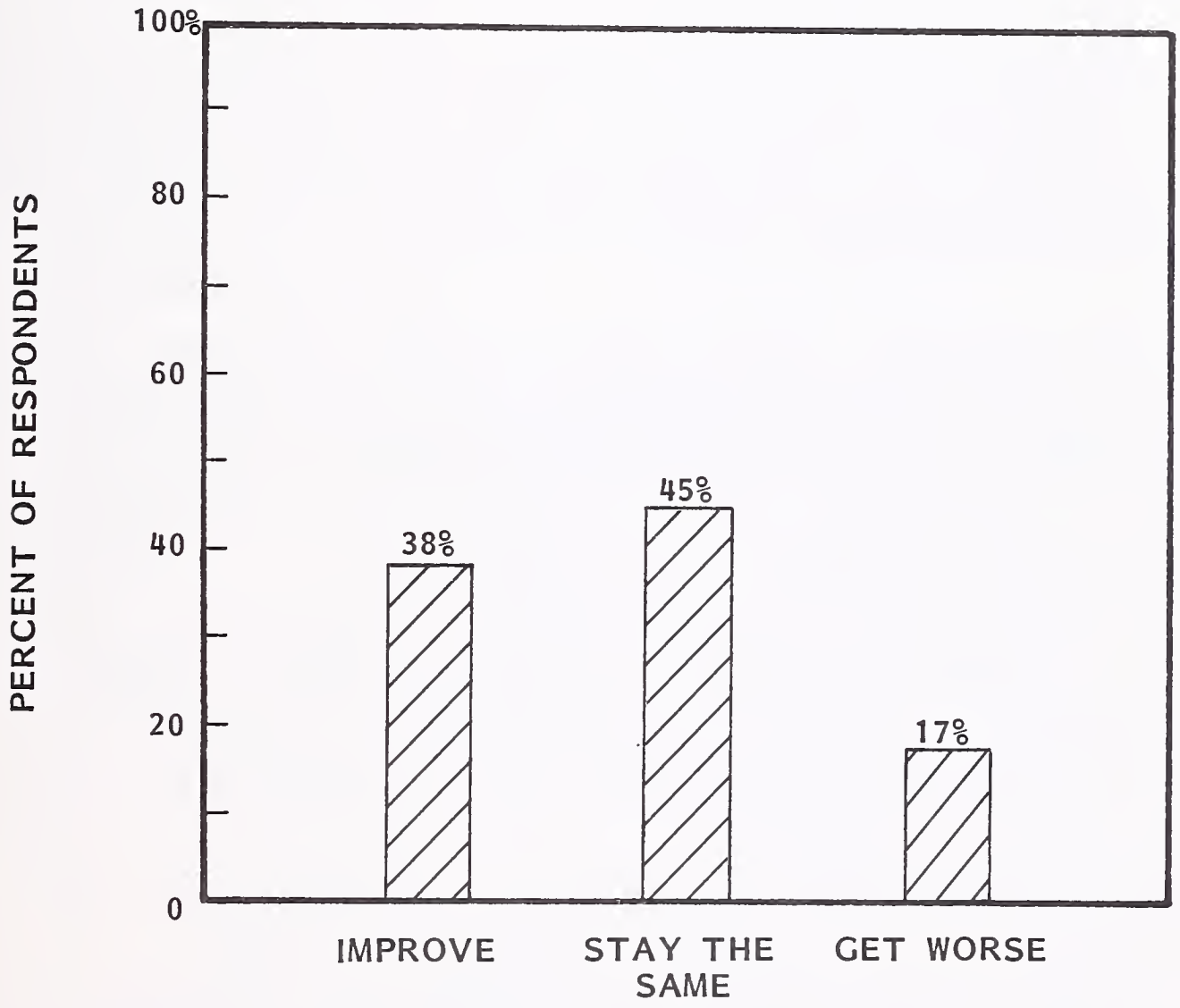
EXHIBIT V-10

NON-USERS'
EXPECTATIONS OF FUTURE MAINTENANCE SERVICE



NUMBER OF RESPONSES = 29

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underscores the fact that the use of remote diagnostics in Europe is extremely new.

- Attitudes of respondents who knew they would be using remote diagnostics shortly did not vary significantly from the other non-users.

C. ATTITUDES OF EXPERIENCED USERS

- In the course of the user survey, INPUT had great difficulty finding users who had enough experience with remote diagnostics to comment knowledgeably about its effect on their maintenance. Only 17 users in this category, all located in the U.K. and France, were fully interviewed. Equipment maintained with the use of remote diagnostics was from four suppliers: DEC, IBM, Amdahl and Univac.

- When asked for a general reaction to remote diagnostics, user comments ranged from 'ineffective' to 'essential', with everything in between mentioned as well. A few of the more interesting comments were:

  - 'Done by supplier for his own advantage.'

  - 'Useful for proving to engineer that equipment is at fault.'

  - 'Fabulous for remote site.'

  - 'Good idea as long as it's free.'

- Of the 17 firms interviewed, nine said their remote diagnostics were used to troubleshoot only hardware, while the other eight said that it was used to address both software and hardware problems.

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- In the case of one manufacturer, both answers were given for the same equipment! INPUT interprets this duality as symptomatic of the fact that many users do not understand the service being provided, which is both an educational and a marketing problem.

- As shown in Exhibit V-11, most users gave high marks to their remote diagnostic facilities. When this chart is compared with Exhibit V-2 (which gives similar information concerning how non-users feel about remote diagnostics), a shift to higher acceptance of the concept is clearly seen. The obvious conclusion is that, once used, remote diagnostics become a readily accepted maintenance technique.

- The ultimate test, of course, is the impact that remote diagnostics have on system availability. Of the 17 respondents, about half said that availability did improve, and quoted figures ranging from 10-20% improvement. The other half either said it had no effect or stated that not enough data were available to comment either way.

- Only a small percentage of users (five out of 17) experienced any problems with their remote diagnostic systems, and, in general, those mentioned appeared to be minor. Examples of problems cited were:

  - 'Problems during installation were cured in three days.'

  - 'Sometimes wrong parts dispatched.' (Obviously a system problem, not a diagnostic one.)

  - 'Engineer forced to start at square one when running diagnostics. Needs a voice communications link as well.'

- Experienced users were asked the same questions about data security as were non-users. The results are shown in Exhibit V-12 and should be compared with the non-user responses given in Exhibits V-4 and V-5. The comparison clearly shows that many of the users' anticipated worries about data security are sharply diminished once the remote diagnostic system has been tried.

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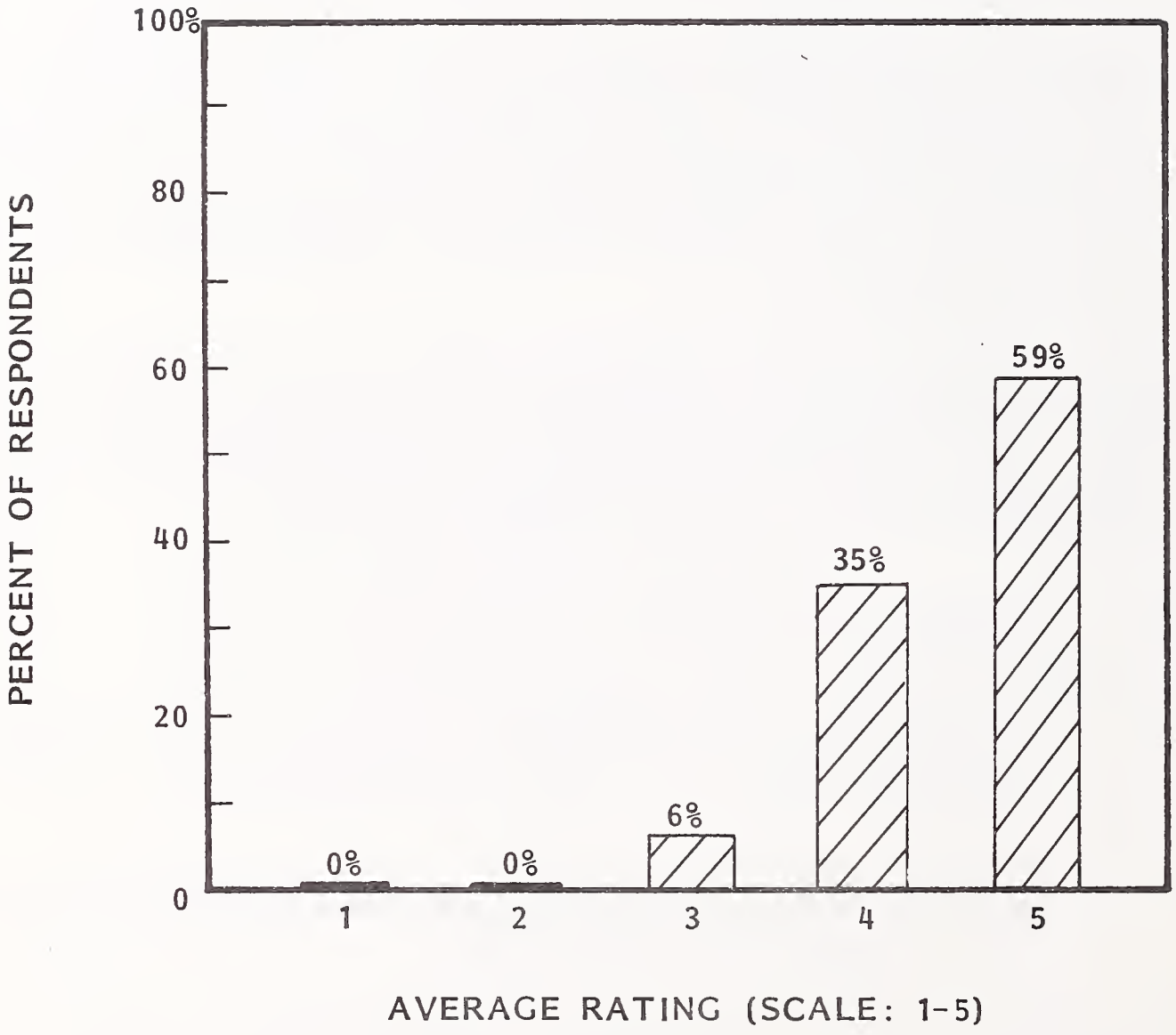
EXHIBIT V-11

EXPERIENCED USERS' ACCEPTANCE OF REMOTE DIAGNOSTICS



NUMBER OF RESPONSES = 17

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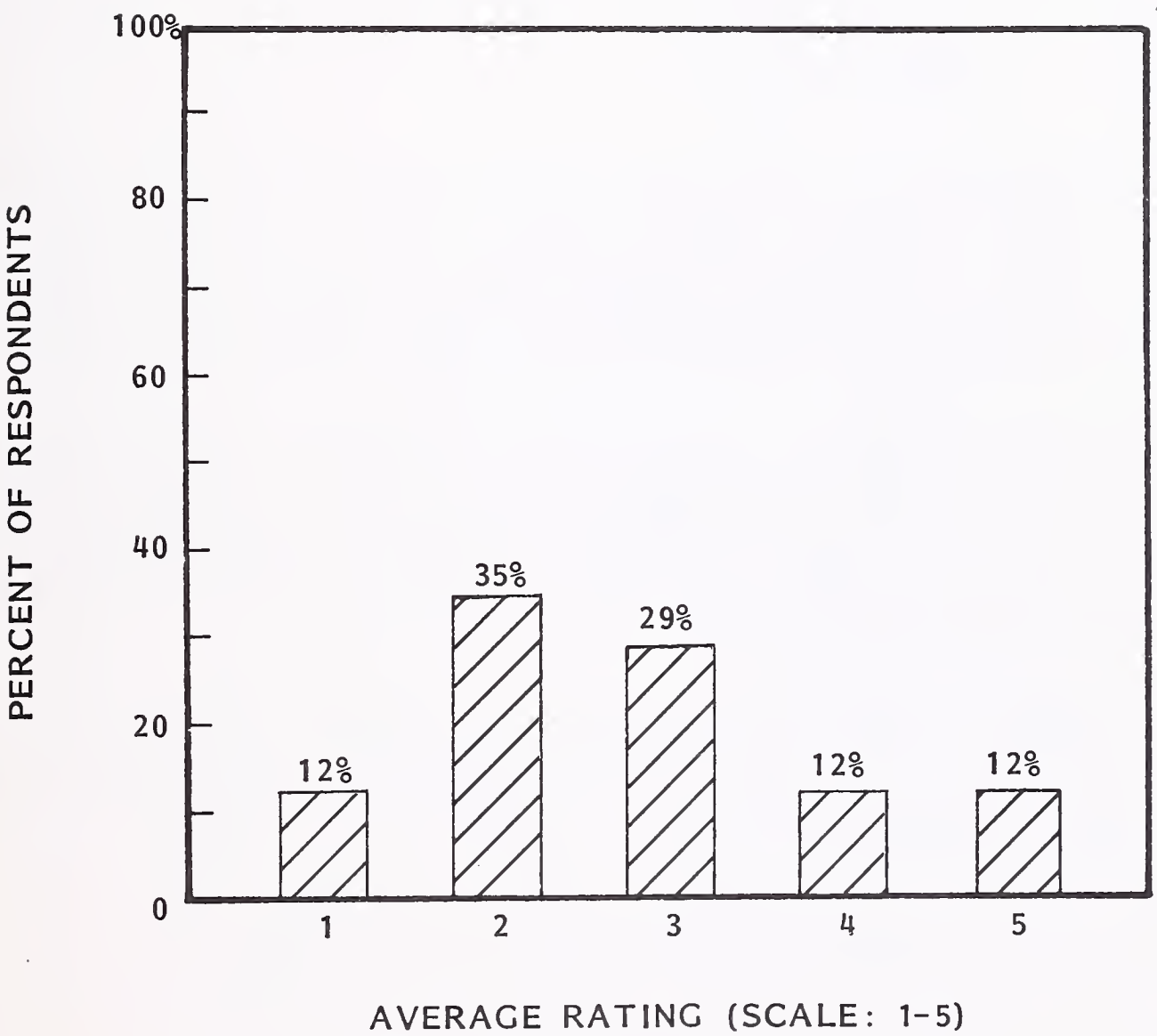
EXHIBIT V-12

EXPERIENCED USERS'
DEGREE OF CONCERN WITH DATA SECURITY



NUMBER OF RESPONSES = 17

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- Users were asked to compare their field service engineer's performance before and after the introduction of remote diagnostics. The results are illustrated in Exhibit V-13. Although the sample is admittedly small, there is nevertheless a clear indication that users perceive better engineer performance after the introduction of remote diagnostics than before it.

- Most users (12 out of 17) said that the introduction of remote diagnostics had no effect on their maintenance costs, although nine out of 12 said they had initially expected them to go down. Numbers quoted were in the 2-5% range.

  - A few users appeared to feel resentful toward their suppliers. They felt that remote diagnostics resulted in savings to the vendor that were <u>not</u> passed on to them.

- Experienced users were also asked about their concern for diminished direct contact with field service engineers. The results to this query, shown in Exhibit V-14, should be compared with those of Exhibit V-6. Again we have a situation where users' concerns have greatly decreased with experience.

- Users were asked to comment on the acceptability of using remote diagnostics for carrying out preventive maintenance. The answers to this question were inconclusive. Few users really had enough experience with it to make a knowledgeable evaluation.

- Of the 17 respondents, five stated that they were actually carrying out board or module replacement at the direction of an instruction received from a remote diagnostic.

  - The majority of users said that they were willing to do so if:

    . They were trained by the vendor.

    . There was no possible way that any warranties could be voided.

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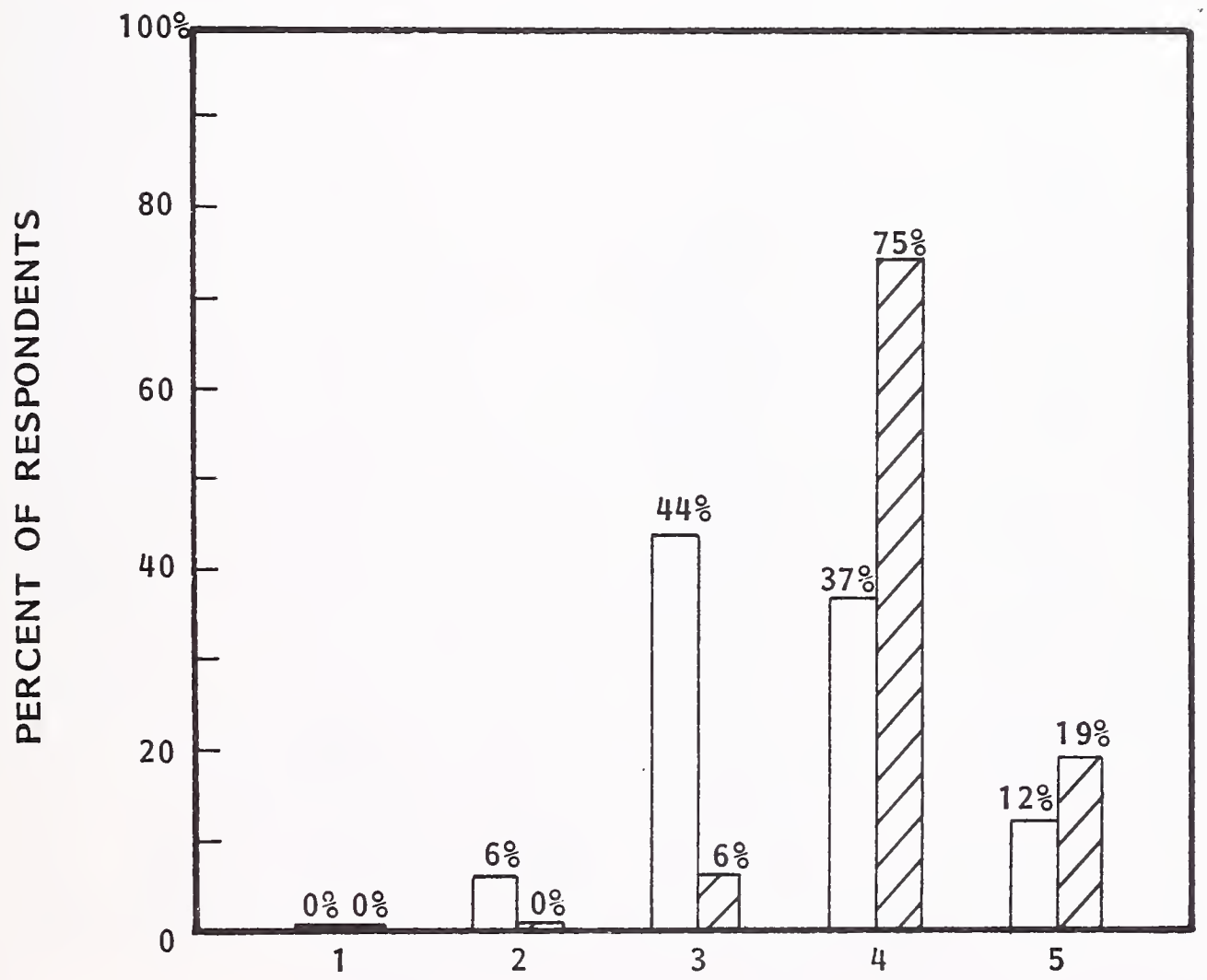
EXHIBIT V-13

FIELD SERVICE ENGINEERS' PERFORMANCE
AS PERCEIVED BY USERS



NUMBER OF RESPONSES = 16

☐ BEFORE INTRODUCTION OF REMOTE DIAGNOSTICS

▨ AFTER INTRODUCTION OF REMOTE DIAGNOSTICS

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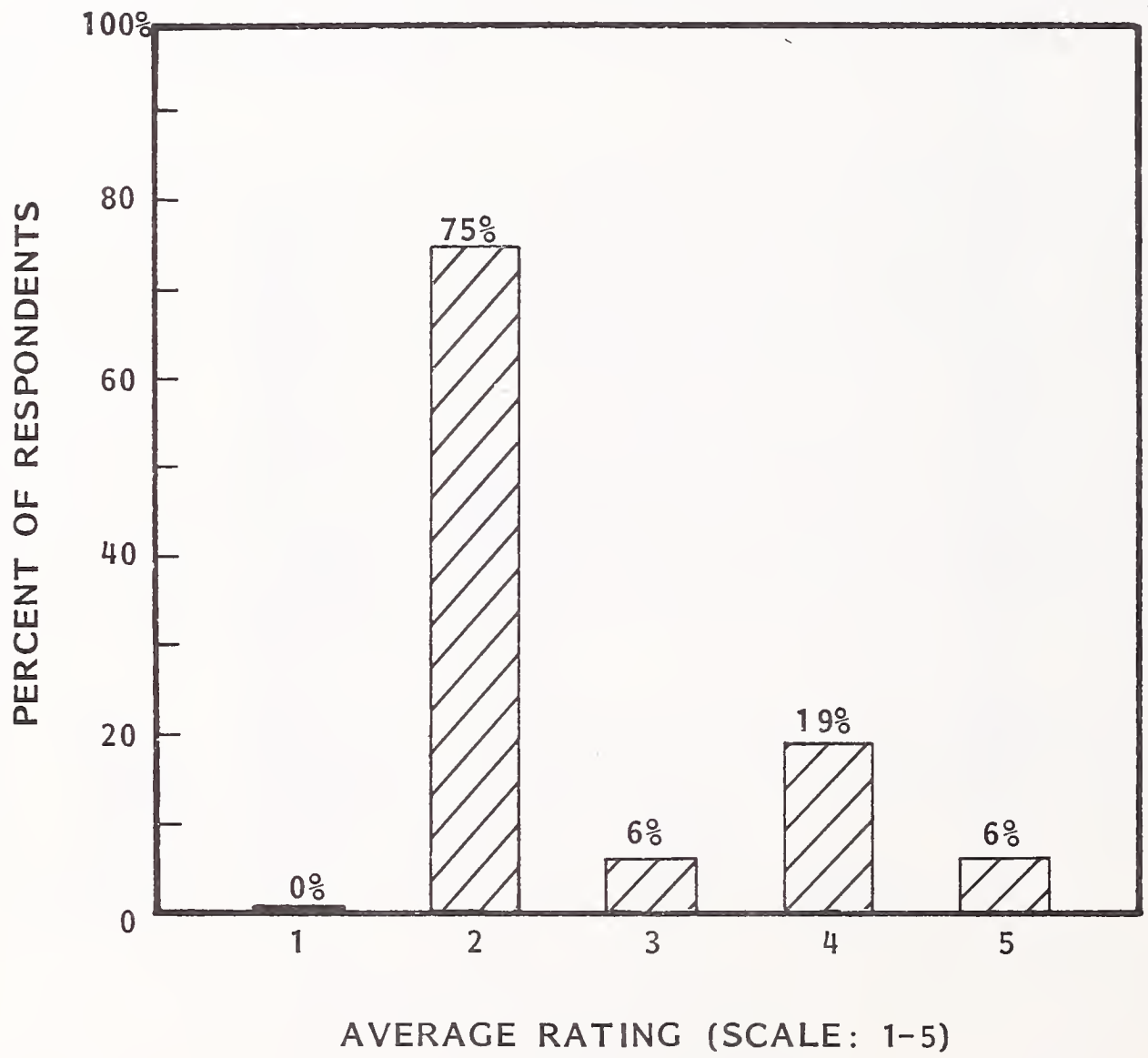
EXHIBIT V-14

EXPERIENCED USERS'
DEGREE OF CONCERN FOR DIMINISHED DIRECT
CONTACT WITH FIELD SERVICE ENGINEERS



NUMBER OF RESPONSES = 17

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- The few users who would not consider doing any replacement tasks had IBM or Amdahl installations.

- At the conclusion of the interviews, users were asked whether they would recommend using remote diagnostics to others. The result was a 100% 'Yes' vote.

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APPENDIX A: REMOTE DIAGNOSTICS DEFINITIONS

APPENDIX A: REMOTE DIAGNOSTICS DEFINITIONS

- Remote diagnostics are a tool for use by field engineering staff in fault detection, debugging and system checking from a remote site by the use of telephone lines and/or data links.

  - True remote diagnostics involve the ability to replace the on-site console with a remote device and exercise the system as if present on-site.

    . Remote diagnostics may require the whole system or run under operating system.

  - A remote diagnostic centre is a location where normally a group of engineers reside with the ability to remote diagnose a number of systems.

  - Dumb remote diagnostics involve the ability to inspect the system, involving mainly error logs without the option of running diagnostic tests.

  - Intelligent remote diagnostics involve the ability - by the use of a remote intelligent device - to inspect the system logs, run diagnostic checks, locate component failure and direct and assist on-site engineers in fault finding. An operator instigates and controls the operation.

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- Remote computerised diagnostics are an extension of intelligent remote diagnostics, in which a computer takes the part of an operator and carries out the control functions, following predetermined logical steps in diagnostic checking and fault finding.

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APPENDIX B: CONFIGURATION PRICES (U.S.)

EXHIBIT B-1

IBM 4331 CONFIGURATION PRICES (U.S.)

COMPONENT	PURCHASE PRICE	ANNUAL MAINTENANCE
A. CPU		
4331 PROCESSOR-IMB	$ 76,100	$ 2,016
3278-2A CONSOLE	2,680	294
CPU SUBTOTAL	$ 78,780	$2,310
B. I/O		
3310-A2 DISC STORAGE UNIT (2)	47,460	2,472
3310-B2 DISC STORAGE UNIT (2)	41,500	2,124
8809 TAPE CONTROL AND DRIVE	11,500	660
3289 LINE PRINTER-400LPM	14,600	2,460
I/O SUBTOTAL	$115,060	$ 7,716
C. TERMINALS		
3278-2 DISPLAY STATIONS (3)	30,420	2,106
TERMINAL SUBTOTAL	$ 30,420	$ 2,106
TOTAL	$224,260	$12,132

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EXHIBIT B-2

IBM 4341 CONFIGURATION PRICES (U.S.)

COMPONENT	PURCHASE PRICE	ANNUAL MAINTENANCE
A. CPU		
4341 PROCESSOR-2MB	$257,250	$ 6,564
3278-2A OPERATOR DISPLAY	2,680	294
CPU SUBTOTAL	$259,930	$ 6,858
B. I/O		
3880-1 STORAGE CONTROL	68,730	2,112
3370-A1 DISC DRIVE AND CONTROL	38,690	1,512
3370-B1 DISC DRIVE (3)	77,390	3,402
3411 TAPE CONTROL AND DRIVE	13,080	1,368
3410-1 TAPE DRIVE (20 KB) (3)	17,805	2,664
3203-5 PRINTER-1200 IBM	38,320	4,692
1416 PRINT TRAIN	2,795	TIME AND MATERIALS
I/O SUBTOTAL	$256,810	$15,750
C. TERMINALS		
3274-1A TERMINAL CONTROL (SNA) (2)	37,540	2,640
3278-4 3440 CHAR. DISPLAYS (45)	127,575	8,910
TERMINAL SUBTOTAL	$165,115	$11,550
TOTAL	$681,855	$34,158

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EXHIBIT B-3

IBM 370/138 CONFIGURATION PRICES (U.S.)

COMPONENT	PURCHASE PRICE	ANNUAL MAINTENANCE
A. CPU		
3138N PROCESSOR-IMB	$247,900	$16,020
CPU SUBTOTAL	$247,900	$16,020
B. I/O		
3830-2 STORAGE CENTRAL	47,580	1,656
3330-1 DISK STORAGE	19,340	1,200
3411-3 MAGTAP UNIT AND CONTROL	26,180	1,428
1403-7 PRINTER 6001pn	22,190	3,624
1416-1 TRAIN CARTRIDGE	2,795	TM
I/O SUBTOTAL	$112,085	$ 7,908
C. TERMINALS		
3274-ID CONTROL UNIT	18,770	1,210
3278-5 DISPLAY STATION	3,285	222
3564 CLEAR		
TERMINAL SUBTOTAL	$ 22,055	$ 1,432
TOTAL	$382,040	$25,360

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APPENDIX C: QUESTIONNAIRES

PROJECT: FIELD SERVICE PROGRAM / EUROPE

USER - REMOTE DIAGNOSTIC - QUESTIONNAIRE

1) Who is your Maintenance Vendor? _____

2) Do you know of a Remote Diagnostic * Capability of your Vendor?

☐ YES ☐ NO Go to Q.20

* Note: Not a telephone conversation to fix a problem.

3) What's your reaction to it? (Quotes)

_____

_____

_____

4) Is this Remote Diagnostic just

☐ Software, ☐ Hardware or ☐ Both.

5) Please rate on a scale of 1 to 5 with 1 = Low, 3 = Medium, 5 = High; your acceptance of the concept of Remote Diagnostics.

_____

1 2 3 4 5

6) Do you use this Remote Diagnostic Capability?

☐ YES ☐ D/K* ☐ NO

(* Don't Know)

If NO why not? (go to Q.22)

_____

_____

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7) How does it work (who does what and when)?

_____

_____

_____

_____

_____

8) Has R.D. improved your system performance or availability?

☐ YES ☐ D/K ☐ NO

By what percentage? _____%

9) Have you experienced any problems?

☐ YES ☐ NO

(If YES) like what? _____

_____

_____

10) Rate your concern about the security of your data with regard to Remote Diagnostics: (on a scale of 1 to 5, 1 = Low, 3 = Medium, 5 = High)?

_____

1 2 3 4 5

Comments: _____

_____

_____

11) Please rate your Field Services Engineer's performance on a scale of 1 to 5 (with 1 = Low, 3 = Medium and 5 = High).

Before R.D. was introduced _____

1 2 3 4 5

After R.D. was introduced _____

1 2 3 4 5

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12) What effect, if any, has the use of R.D. had on your maintenance cost?

☐ Increased By what percent _____%

☐ None

☐ Decreased By what percent _____%

13) Did you expect any change in your maintenance cost?

☐ YES ☐ NO

If YES such as? _____

_____

_____

14) Please rate on a scale of 1 to 5 (1 = Low, 3 = Medium, 5 = High) the overall performance of Remote Diagnostics:

_____

1 2 3 4 5

15) Would you recommend Remote Diagnostics to another user?

☐ YES ☐ D/K ☐ NO

Why? _____

_____

_____

_____

16) If by the use of Remote Diagnostics you saw less of your Field Service Engineers would this worry you, please rate on a scale of 1 to 5 (1 = Low, 3 = Medium, 5 = High)?

_____

1 2 3 4 5

Comments: _____

_____

_____

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17) Please rate your acceptance of Preventive Maintenance being carried out by the Remote Diagnostics Capability: scale 1 to 5, 1 = Low, 3 = Medium, 5 = High.

1 2 3 4 5

18) Do your staff do any module/board changes under the direction of Remote Diagnostics?

☐ YES ☐ NO

If YES

a) Please explain

If NO

b) If Remote Diagnostics could locate a failing module and assuming you had a spare on site please rate your willingness to have an operator open up the CPU and change that module (1 = Low, 3 = Medium, 5 = High)

1 2 3 4 5

Comments

19) Do you see the concept of Remote Diagnostics spreading?

THANK YOU FOR YOUR HELP

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IF NO TO Q.2

20) Are you familiar with the concept of Remote Diagnostics*? (R.D.)

☐ YES ☐ NO

If NO explain (see attached)

(Note: Not a fix by telephone!)

21) What's your reaction to the concept? (Quotes)

_____

_____

_____

_____

22) Rate on a scale of 1 to 5 with 1 = Low, 3 = Medium and 5 = High, your willingness to use Remote Diagnostics

_____

1 2 3 4 5

If 2 or less, why? _____

_____

_____

_____

23) Rate your willingness to co-operate with your vendor on the introduction of Remote Diagnostics (on a scale of 1 to 5 1 = Low, 3 = Medium, 5 = High)

_____

1 2 3 4 5

If 2 or less why? _____

_____

_____

_____

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24) Please rate your concern regarding the security of your data base with a vendor having R.D. on your system (on a scale of 1 to 5, 1 = Low, 3 = Medium, 5 = High)

1 2 3 4 5

Comments _____

25) Please rate you concern on lost data or machine crashes caused by Remote Diagnostics (on a scale of 1 to 5, 1 = Low, 3 = Medium, 5 = High)

1 2 3 4 5

Comments _____

26) By the use of Remote Diagnostics you saw less of your Field Service Engineer would this worry you, please rate on a scale of 1 to 5 (1 = Low, 3 = Medium, 5 = High)?

1 2 3 4 5

Comments: _____

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27) If Remote Diagnostics could locate a failing module in the CPU and assuming you had a spare on site please rate you willingness to have an operator change that module (1 = Low, 3 = Medium, 5 = High).

1 2 3 4 5

Comments _____

28) What effect do you expect Remote Diagnostics to have on?

a) Your system availability _____

b) Your maintenance charges _____

c) Your Field Service Engineer _____

d) Your System Reliability _____

e) Response Time _____

f) Repair Time _____

g) Other _____

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29) Please rate your Field Services Engineers performance on a scale of 1 to 5 with 1 = Low, 3 = Medium, 5 = High.

1 2 3 4 5

Comments _____

_____

_____

_____

30) Do you expect your quality of maintenance in the next two years to?

☐ Improve ☐ Stay the same ☐ Decline

Comments _____

_____

_____

_____

THANK YOU FOR YOUR HELP

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FSPIP/E

VENDOR QUESTIONNAIRE FOR REMOTE DIAGNOSTICS

1) Do you have a Remote Diagnostic capability? ☐ YES ☐ NO

Go to Q.2.

1a) If NO do you intend having one? ☐ YES ☐ NO

1b) If YES by when? _____

1c) If NO why not? _____

_____

_____

(Go to Q.30)

Note: Q.2 to Q.24 should be answered if either vendor has a Remote Diagnostic system or is about to implement one.

2) Is this for?

☐ Software ☐ Hardware ☐ Both

2a) What is the main reasons for using Remote Diagnostics?

_____

_____

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3) Please give a brief outline of your Remote Diagnostic system and how it operates.

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3a) Who initiates? _____

_____

3b) When a fault is detected please outline the procedure.

_____

_____

_____

_____

_____

_____

3c) Is there a difference between Hardware and Software fault detection and fix without an engineer visiting site?

Hardware	_____ % Detected	_____ % Fixed
	_____ % Detected	_____ % Fixed

3d) Can you down load Software patches and fixes to customer systems?

☐ YES ☐ NO

If YES please describe.

_____

_____

3e) Does your Remote Diagnostic need the whole system or does it run under the users operating system?

☐ Whole System ☐ Operating System

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3f) Can you identify minor failures and correct before system degradation occurs?

☐ YES ☐ NO

If YES please describe.

_____

_____

_____

_____

4) On which equipment is Remote Diagnostics available?

_____

_____

_____

5) Is this list being expanded? ☐ YES ☐ NO

5a) If YES by which equipment?

_____

_____

5b) If NO why not?

_____

_____

5c) Do you have Remote Diagnostic centers? ☐ YES ☐ NO

If YES where are they located?

_____

_____

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6) Please rate on scale of 1 to 5; with 1 = Low, 3 = Medium, 5 = High; the importance your company attaches to Remote Diagnostics.

1 2 3 4 5

6a) If 2 or less

Why so low an importance?

7) Please rate, again on a 1 to 5 scale with 1 = Low, 3 = Medium, and 5 = High; your companies commitment to the implementation of Remote Diagnostics

1 2 3 4 5

7a) If 2 or less

Why so low?

8) Please rate using the same scale of 1 to 5, (1 = Low, 3 = Medium, 5 = High) your sales/marketing departments acceptance of the Remote Diagnostic concept.

1 2 3 4 5

8a) If 2 or less, what is the problem with their acceptance?

9) Again on a scale of 1 to 5 please rate the engineers acceptance to Remote Diagnostic concepts.

1 2 3 4 5

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9a) Have you experienced any problems with engineers and Remote Diagnostics?

_____

_____

_____

10) Has or will Remote Diagnostics cause any internal organisation changes?

☐ YES ☐ NO

If YES please describe

_____

_____

_____

11) Please rate the users acceptance, on a scale of 1 to 5 with 1 = Low, 3 = Medium and 5 = High, of Remote Diagnostics

_____

1 2 3 4 5

If 2 or less why was this unacceptance?

_____

_____

_____

12) What has been the main problems with users and the introduction of Remote Diagnostics?

_____

_____

_____

_____

_____

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13) How was or how will Remote Diagnostics be 'Sold' to your user?

_____

_____

_____

14) Have you had any major failures with Remote Diagnostics?

☐ YES ☐ NO

If YES please describe.

_____

_____

_____

15) Please rate on a scale of 1 to 5, with 1 = Low, 3 = Medium, and 5 = High, the general level of concern expressed by users regarding the security of their data base.

_____

1 2 3 4 5

15a) If 3 or more how did you overcome these concerns?

_____

_____

_____

16) On a scale of 1 to 5 please rate the users concern as to the losss of a personnal interface (i.e. FE/CE) when he has a problem (1 = Low, 3 = Medium, 5 = High)

_____

1 2 3 4 5

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16a) If 4 or more what did you do to comfort your users?

_____

_____

_____

17) How has Remote Diagnostics effect the efficiency of your FE/CE?

☐ Increased ..... by what _____%

☐ Stayed the same

☐ Decreased ..... by what _____%

18) Was this expected? ☐ YES ☐ NO

18a) If NO what was the expected effect?

☐ Increase ..... by what _____%

☐ Same

☐ Decreased ..... by what _____%

19) Does your Remote Diagnostic system give any Management Reporting Capability?

☐ YES ☐ NO

19a) If YES please describe.

_____

_____

_____

19b) If NO will this be added later?

☐ YES ☐ NO

19c) If YES when? _____

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19d) If NO why not?

_____

_____

_____

20) Does your Remote Diagnostic system have any spares order/control capability?

☐ YES ☐ NO

20a) If YES please describe.

_____

_____

_____

20b) If NO will this be added?

___ YES WHEN _____

___ NO WHY NOT _____

_____

21) Has the PTT proved a problem?

☐ YES ☐ NO

If YES what was the problem(s)?

_____

_____

_____

22) Has the available baud rate been a problem?

☐ YES ☐ NO

If YES please describe.

_____

_____

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22a) What is the desired baud rate? _____

23) How are your engineers trained on Remote Diagnostics? ☐ NONE

_____

_____

_____

_____

_____

23a) Is it effective?

☐ YES ☐ NO

23b) If NO why Not?

_____

_____

_____

24) Was your Remote Diagnostic system first developed and used in another country?

☐ YES ☐ NO

24a) If YES where? _____

_____

_____

24b) And when _____

25) If they have a brochure remind them to send you one.

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Q.30 TO 34 ONLY TO BE ANSWERED IF VENDOR DOES NOT HAVE OR NOT IMPLEMENTING REMOTE DIAGNOSTICS

30) Please rate on a scale of 1 to 5 with 1 = Low, 3 = Medium, 5 = High, your concern at not having a Remote Diagnostic Capability.

1 2 3 4 5

30a) If 3 or more, what are you planning to do about it and how?

31) Have any of your users expressed interest in Remote Diagnostics?

☐ YES ☐ NO

31a) If YES please rate their interest on a scale of 1 to 5 with 1 = Low, 3 = Medium and 5 = High.

1 2 3 4 5

31b) If 3 or more can you let me have some examples of their interest?

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32) Please rate on a scale of 1 to 5 (1 = Low, 3 = Medium, 5 = High) the future use of Remote Diagnostics in the computer industry.

1 2 3 4 5

33) Of the other computer vendors do you know of their Remote Diagnostic Capabilities?

☐ YES ..... WHO _____

☐ NO

34) Does it worry you they are going ahead on Remote Diagnostics?

☐ YES ☐ NO

Why or why not

_____

_____

_____

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